TRANSACTIONS

AND

YEAR BOOK

UNIVERSITY OF TORONTO
ENGINEERING SOCIETY

APRIL, 1932

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[Vol 45]

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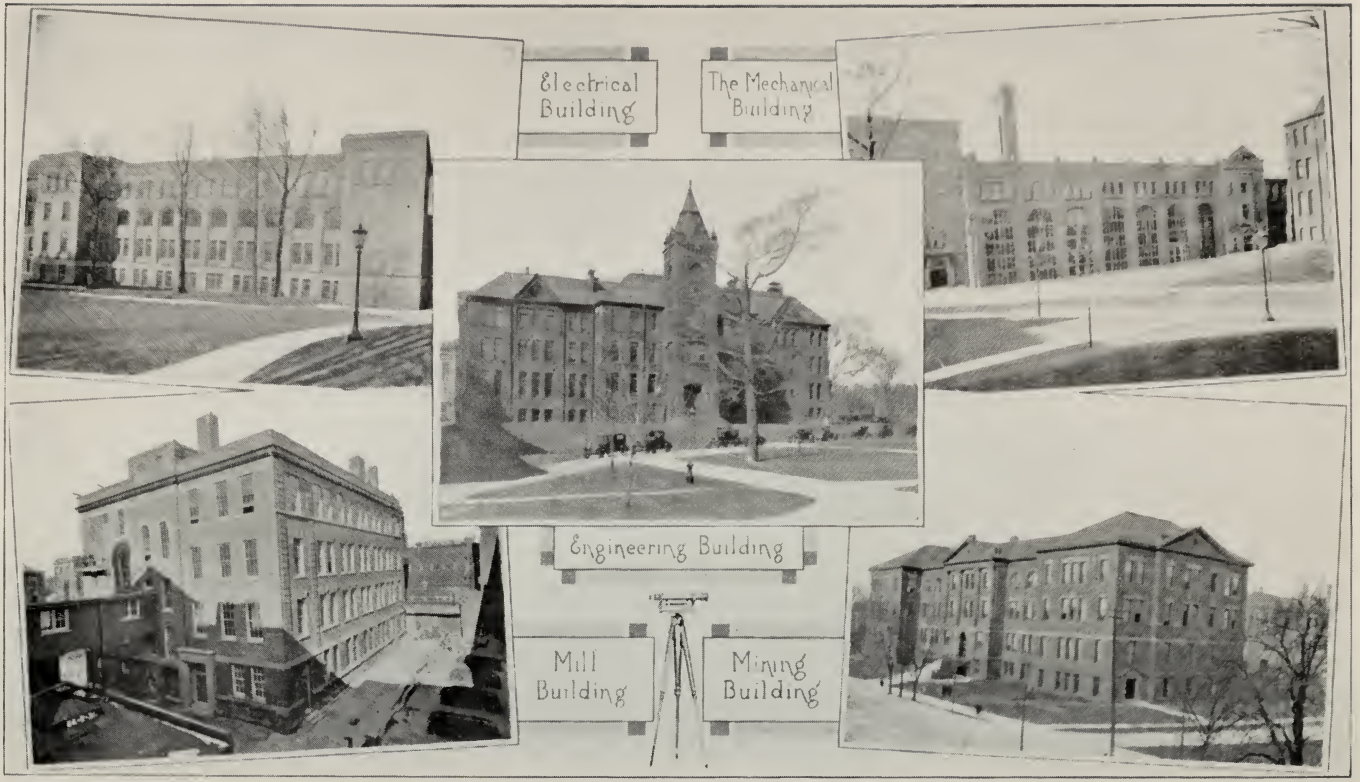
Electrical Building
The Mechanical Building
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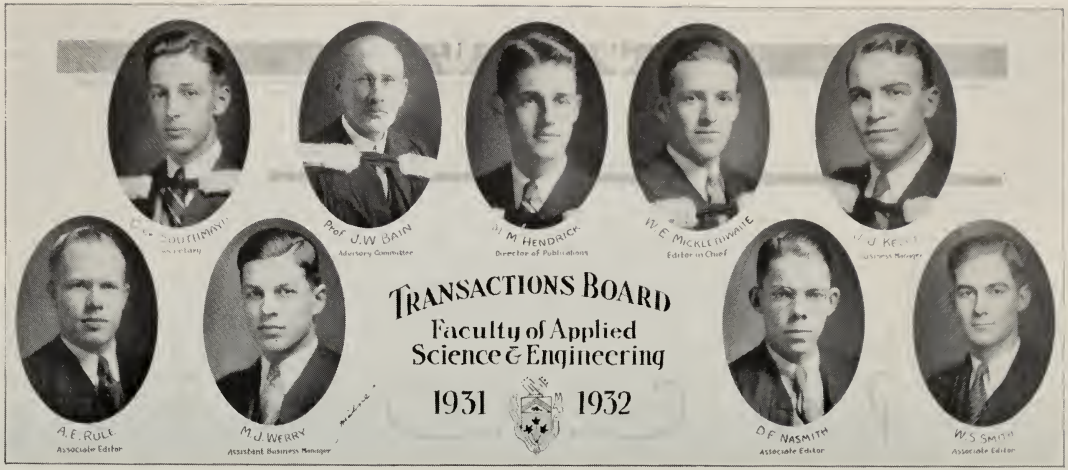
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TRANSACTIONS AND YEAR BOOK

OF THE

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

No. 45 APRIL, 1932

EDITORIAL

Once more, at the close of another eventful and successful year, the Engineering Society presents TRANSACTIONS to its members and many friends. It is the earnest hope of the Board that TRANSACTIONS will serve as a permanent record of the well-organized and varied accomplishments of the Society. Our success may be judged by what follows. For any errors and omissions, we apologize—they are our loss; and the criticisms and contributions of our readers will be welcomed.

In the selection of material, the policy of the Board has been slightly modified, due largely to the fact that, while highly entertaining and productive of capacity attendance, the papers presented before the Society were not of sufficient formality to be published verbatim. Accordingly we include only brief reviews of the year's meetings. With these, TRANSACTIONS includes three theses of the graduating year selected from those available for their interest and value, a note on the work of the School of Engineering Research where valuable results are being achieved, Dr. M. C. Boswell's address to the Chemical Club and that of Canon A. P. Shatford at the School Dinner.

In passing, we would point out to future club chairmen their duty and their opportunity of publishing worth-while papers read at their meetings.

We have been very fortunate in obtaining a brief message from Sir Robert Falconer, our beloved President, whose retirement is deeply regretted by all School. We wish him happiness in a well-earned holiday and turn with confidence to the leadership of his genial and widely-known successor, Canon Cody.

May we take this opportunity of expressing our appreciation of the efforts of all those whose contributions and energy have made this publication possible.

SIR ROBERT A. FALCONER, K.C.M.G., D.Litt., LL.D., D.C.L., Oxon.
President of the University of Toronto 1906-1932

FAREWELL MESSAGE
FROM
SIR ROBERT FALCONER

To The Editor

I thank you for the opportunity you have given me of writing a few words of farewell to the students of your faculty. Of all the faculties there is none more unified, none that rallies more loyally to support general activities, none in which the students have warmer hearts. When your hosts are martialled they seem to be able to carry everything before them, but at the call of your leaders you are ready to turn at once to the help of the needy. The engineer is generous to the last degree. This combination of strength and kindliness makes you very human; it also will help you to become leaders of men. Quick to meet emergencies, ready to devise a way out of tight places, reliable to the uttermost when no man's eye is upon you, it may be confidently expected that there will always be opportunities for you in our country. Energy, initiative, fidelity—these qualities of yours will always be in demand. I have tested them in various ways for a quarter of a century, and have not found them to fail. You face life with a smile, and men will always have something decent to say of your profession. The many kindly responses which you and those who went before you have made to my requests I shall never forget, and my heart will beat a little faster when I think of Varsity's engineers.

R. A. Falconer

THE DEAN'S MESSAGE FOR 1932

To the Members of the Engineering Society

GENTLEMEN:

Again the Engineering Society can record a most successful year in student activities in this Faculty. It appears, at this time, that the year has been a most satisfactory one from the academic point of view, but in saying that at this date, we all have mental reservations when we think of the month of April because we realize that it brings the test of the year's work.

In the Engineering Society itself, not only in its meetings, but in its general student activities, I think everyone will agree that it has been one of the most successful years in its history. The meetings of the society itself, as well as those of its constituent clubs, appear to have been well attended and to have provided excellent addresses and papers which have taken their place, as they properly should do, in supplementing the academic work of the curriculum itself. The contents of this volume of TRANSACTIONS will attest this, and I am sure that the Society, and the student body generally, are to be congratulated upon the excellence of this year's publication.

The outstanding feature of the Engineering Society's activities for this year, however, is the establishment of the Society's Loan Fund for the assistance of its student members in their academic advancement. This has been unique and will go down in the history of the Society and of the Faculty as one of the great achievements of the student body. The original conception of returning

to the Board of Governors the large sum which represented the annual grants to the Society for the past seventeen years, together with interest compounded for that long period, was in itself a very happy one and will always be looked upon by the staff and students alike, not only in this Faculty but in the University generally, as a very handsome achievement. The Board of Governors, in returning this sum to the Society for the purpose of the Loan Fund, showed not only an equally happy spirit of co-operation, but indicated the confidence which the Board has in the Engineering Society and its business methods and demonstrated how valuable the proper spirit of reciprocation can be between the student body and the University authorities. That the fund will be well administered and will be of very great use amongst the students of the Faculty goes without saying.

To the Fourth Year, now about to leave, I am sure I can give no better wish than that they will rapidly find themselves in satisfactory and happy fields of engineering activity in the country. Do not let us feel at all pessimistic about the future. It is possible, that as a result of the past twelve difficult months, you may not find your place so readily as your predecessors did, but keep in mind that the present "depression," as far as engineering is concerned, is really not a depression at all, but just a flattening of the rising curve of engineering activity in the country. There is every indication in the business, the industrial and the financial fields that we have now passed the turn and things will slowly get better, especially in so far as engineering is concerned. They never have been so very depressed in the engineering profession during the last two years as in other professions, mainly for the reason that much of the activity in the country has been carried on by the sheer momentum of the previous years and by the efforts which have been made to continue various engineering works, construction or otherwise, in order to help the unemployment situation.

To you who will remain and come back for the next Session of 1932-33, you will have much to look forward to, with the new kinds of work and the new activities which your progression in your engineering education here will bring to you. These prospects must be heartening. Let us hope that you will come back with new resolves and fresh ideals, after a happy summer, put in at any kind of employment you can secure. You will then be ready to enter your seven months of the new year's work with a large factor—or shall we call it a coefficient—which will have a strong influence on the life of the Faculty. If you could put this into mathematics one could imagine that one of the terms in the equation of next year's work would be the familiar one in the hydraulic laboratory, "M V Squared!"

I heartily wish all members of the Engineering Society continued success and again desire to express admiration and congratulation upon the past year's work.

C. H. MITCHELL,
Dean

March 24, 1932.

PRESIDENT'S MESSAGE

SCHOOLMEN:

It is with a keen feeling of regret that I write this last message to you. Regret, because it marks the termination of my active connection with the Engineering Society, and because, in common with the other men of fourth year, I dread the prospect of leaving behind the happy companionship that we have enjoyed these past four years. But, mingled with these feelings, is a sense of satisfaction. From year to year as we progressed, we have seen School become larger, more prosperous, more successful, and it gives us pleasure to think that we, in some measure at least, have made our contributions to her achievements.

This past year has been very outstanding. Your executive has taken every precaution to avoid the upsetting incidents that have with hardly an exception marked the past history of School. Some may say that School is degenerating, and harken back to the "good old days," but this is not true. Schoolmen, instead, are turning to new ideas, and using their abilities to perfect those which have been handed down to them. This has been well illustrated during the past year, and, I believe, will mark an upward turn in School's progress.

For a start, let me first speak about the Engineering Society Meetings. These have long been the President's greatest worry, and I am glad to say that at last our efforts have begun to bear fruit, and Schoolmen are taking advantage of these opportunities to hear worthwhile speakers. Realizing, that we, as engineers, must broaden our perspective of world affairs, as well as become proficient in the various specialized branches of our profession, the Engineering Society Executive adopted the policy of making the Engineering Society Meetings more general in character; securing, whenever possible, prominent men who could speak on subjects of general interest, such as world problems, economic conditions, and the engineer's place in the world of business.

In order to follow this policy, it was necessary to have meetings at irregular intervals, and to adopt a very extensive advertising campaign. In this last respect, I wish to congratulate, and to thank Max Hendrick for the ingenuity and energy that he used as

Director of Publications and Publicity. It became at once apparent that our new policy was proving successful, and it was not long before even standing room was at a premium. Such turnouts are most gratifying to the men who have had the trouble of arranging the meeting; and I am sure that, if you will continue to give your support, the meetings next year will be even better and more interesting.

By referring to the meetings first, I have rather interrupted the proper sequence of events during the past year. Let us go back to the beginning of the fall term. After the initiations (and its aftermath, which I shall skip over quickly) School settled down to a steady routine of work interrupted for a time by the stellar performance of the Senior School Football team.

The School Dinner on December 1, through the untiring efforts of Ernie Black and his committee, again proved to be the most outstanding event of the year. Schoolmen may be justly proud, that their annual dinner is without exception the finest at the University of Toronto.

School Nite and the School At-Home lived up to past reputations, and were both very successful.

Though our athletic teams have not taken championships in every case, they have all been well up in the running and have maintained School's prestige in University Athletics.

The financial report again shows a healthy balance, thanks to the good work of Stew Ball and Mac McKillop. You will notice that our surplus account in bonds, has dropped about $3,800. This sum was used to repay the grants made by the Board of Governors to the Engineering Society during the period 1914 to 1930. The Board of Governors has very kindly given us the use of this money, and a fund known as the "Engineering Society Loan Fund" has been created and will come into full operation next year.

As usual, the elections created the customary excitement. A innovation this year was the combined athletic and social evening held in Hart House after the elections. I believe that this will prove to be a more popular form of entertainment than the old type held in the second year drafting room. Next year's executive will be well advised to consider its possibilities fully.

I wish to thank Dean Mitchell, and the members of the Faculty who have so kindly given their advice and assistance to the Engineering Society during the past year, and, to the members of the Engineering Society Executive, I wish to express my appreciation for the co-operation they have given to make this one of the most successful years in the history of School. I doubt if a more congenial, capable, and hard working executive was ever before gathered together.

To your new president, Stewart Ball, and to his executive I wish every success. With your hearty support, I feel sure that they will guide School to new and greater achievements.

Yours very sincerely,
E. S. Jewett.

Professor W. S. Guest

It is with sorrow that we record the death, after a lingering illness, of Professor W. S. Guest of the Department of Electrical Engineering. It is almost twenty-five years since he came on the staff as Demonstrator in the Fall of 1907 to take charge of the subject of Electricity for second year students.

In 1912 he became Lecturer and in 1927 Assistant Professor, taking complete responsibility for his subject. Unfortunately within a few years of this he was afflicted by the malady which required a continued leave of absence from his work for the past two years and ultimately caused his death.

His illness was much saddened by the death of a son as the result of a chemical experiment. He was always devoted to his work, intent on the interest of students in his subject, and was much respected by his colleagues.

Dying at the age of 59 he is survived by his widow and one son.

1932

TRANSACTIONS

OF THE

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

FACULTY OF APPLIED SCIENCE
AND ENGINEERING

UNIVERSITY OF TORONTO

RECENT DEVELOPMENTS IN MOTOR CAR TRANSMISSION

Condensed from a Thesis for the Degree of B.A.Sc., in Mechanical Engineering

BY F. G. EWENS

When speaking of the transmission of a motor car, reference is made to the transmission gearset. This gearset is required, because a gasoline engine develops power in proportion to its speed, and the high power is frequently needed with low speed at the driving wheels, as when starting or climbing hills.

Early inventors used many types of gear, belt and friction drive in the effort to discover the ideal means of transmitting the power to the driving wheels. The ideal transmission is one in which the ratio of engine speed to wheel speed is infinitely variable. This was approximated in some of the early types of friction drive, but the slippage in this type proved to be excessive.

The planetary transmission was used for a short time by a number of manufacturers, and until quite recently on the Ford car. It was followed by the sliding gear transmission, the first of which were of the progressive type.

Conventional Gearset

In the progressive type of gearset it was necessary to pass through the intermediate speeds to get into high speed. This was soon changed to the three-speed forward selective transmission, in which case it is possible to go directly from the neutral position to any of the forward speeds or reverse. This was considered the standard of engineering practice, and for almost a score of years very little change was made in the underlying principles of design. Hence it has become known as the conventional gearset.

Figure 1 shows the conventional gearset construction, the gears being in their neutral position. Power is delivered to the gearset through the shaft A and gear B, and delivered to the rear axle through the splined transmission shaft D. On shaft D are mounted the second and high-speed shaft gear C, and the low and reverse shaft gear H, both of which are splinded to the shaft, enabling them to slide along it. The countershaft F is driven by the gear B, which is in constant mesh with gear E. On the countershaft are mounted, the second speed countershaft gear G, low speed countershaft gear J, and reverse countershaft gear K. The latter is in constant mesh with the reverse idler gear L, which is mounted on the idler shaft M. Whenever the clutch is in, shafts A, F, and M, and gears B, E, G, J, K, and L are all revolving.

Figure 2 shows the gears in high speed or direct drive, with the gear C moved along the shaft until its internal teeth engage with external teeth on the gear B.

Figure 3 shows the gears in second or intermediate speed, with

gear *C* moved backward on the shaft until it engages with the second speed countershaft gear *G*.

Figure 4 shows the gears in low speed, with gear *H* moved forward until it engages the countershaft low speed gear *J*.

Figure 5 shows the gears in reverse drive, with gear *H* moved backward until it engages the reverse idler gear *L*.

Mechanically this transmission has proved quite satisfactory, but for some years automotive engineers have agreed that gearset design could be improved in at least two respects; namely, those which affect the ease of shifting gears, and those controlling noise in operation. It was with these ideas in mind that the more recent changes in the transmission gearset have been made.

Four-Speed Gearset

The four-speed forward gearset was developed some years ago, and has recently had a fresh run of popularity. In the newer types, the internal-external gear application has been used to secure quietness of operation and flexibility of drive. It is claimed that the four-speed gearset keeps the engine running at a speed which is lower, more comfortable and less destructive when the car is traveling at high speed. The quiet third speed is frequently called a second high speed. As few motorists drive continuously at speeds greater than fifty miles per hour, in many cases the fourth speed is seldom used, and for rapid acceleration the gear must be placed in third speed. For these reasons, and due to the fact that three-speed gearsets can now be made to operate just as quietly as four-speed, many automobile experts have decided that the fourth speed is unnecessary, and only adds considerably to the cost of the gearset. Many different designs of four-speed transmissions have been developed, but due to the recent improvements in three-speed, the present trend on this continent is toward the latter.

Helical and Herringbone Gears

Many manufacturers, using the three-speed gearset, have greatly increased the quietness of operation by the use of helical or of herringbone gears. The quietness is due to the fact that there is a greater tooth surface in contact at any one time with the helical gear. Helical gears, although silent, produce objectionable end thrust. Herringbone gears really consist of two opposed helical gears, which eliminate the end thrust. Using these gears, the manual operation in changing gears is the same as for the conventional type. The gears *B*, *E*, *G*. *C*, of the conventional type are changed to the helical or herringbone type, *B* and *E*, and *C* and *G*, being in constant mesh, with *C* free to rotate on shaft *D* instead of splined to it. As it is impossible to slide either of these gear types into engagement, a dog clutch is splined to the transmission shaft *D* free to slide along it. For high speed this clutch engages with gear B, and for second speed engages with gear *C*, which has external teeth similar to those on gear *B*.

The Reo silent second transmission uses herringbone gears. It

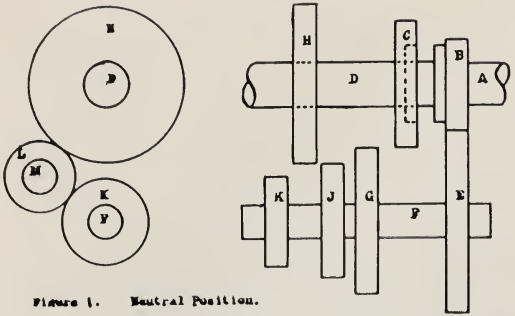

Figure 1. Neutral Position.

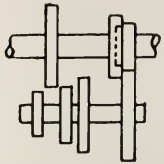

Figure 2.
High Speed.

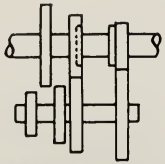

Figure 3.
Second Speed.

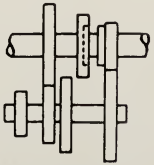

Figure 4.
Low Speed.

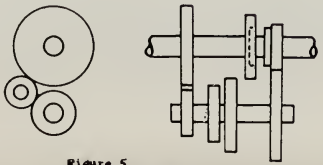

Figure 5.
Reverse Drive.

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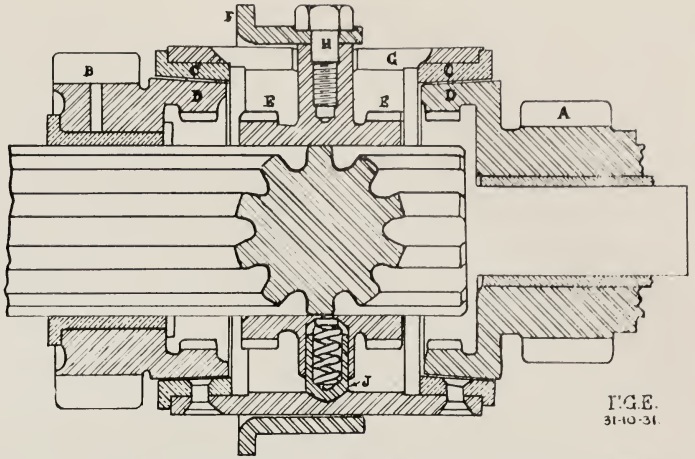

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Figure 6. Synchro-Mesh Unit on Mainshaft between High and Second Gears.

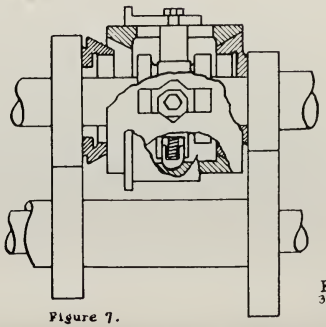

Figure 7.
Cones in Contact for High Speed.

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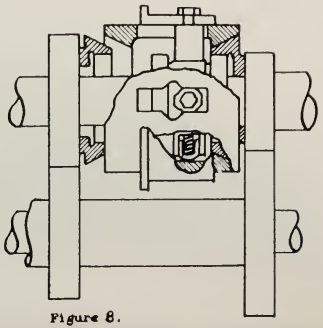

Figure 8.
Gears in Mesh for High Speed.

STUDEBAKER FREE-WHEELING TRANSMISSION

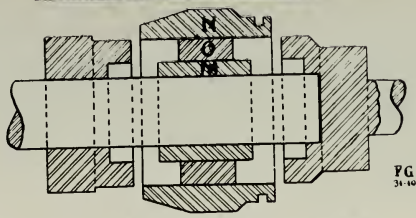

Figure 9. Free-Wheel Unit on Mainshaft between High and Second Speed Gears.

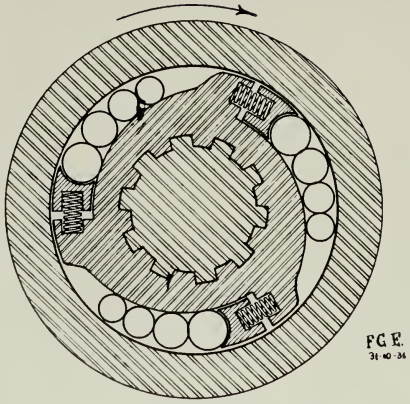

Figure 10. Cross Section of Studebaker Free-Wheel Unit.

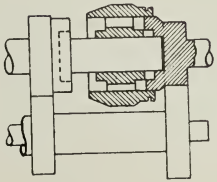

Figure 11.
Free-Wheeling High Speed.

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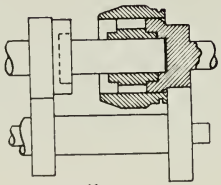


Figure 12.
Conventional High Speed.

THE WILLYS FREE WHEELING CLUTCH

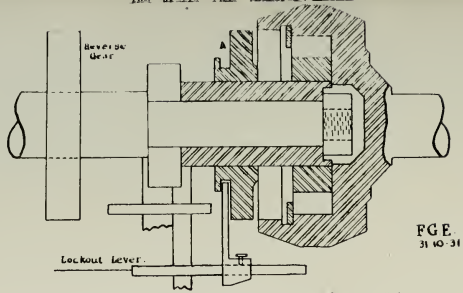


Figure 13. Free-Wheel Unit Mounted to Rear of Transmission.

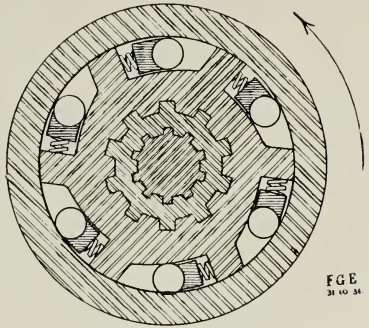
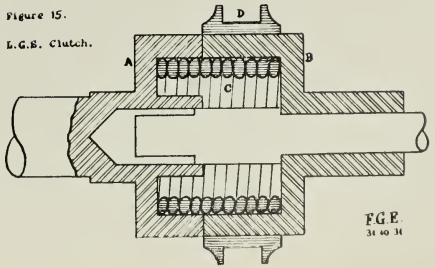


Figure 14. Section through Free-Wheel Unit.

Figure 15.
L.G.S. Clutch.



is claimed that the noiseless second gear permits shifting without noise or clashing from high to second at forty miles per hour, and from second to high at any speed. The gearset is adaptable for drive in heavy traffic, and is convenient for mountain driving where second gear is generally used to save wear on the brakes.

Synchro-Mesh Transmission

A few years ago, synchro-mesh transmission was adopted in the gearset of a number of cars. As with helical gears, the high and second speed gears are both in constant mesh, the drive being completed through a sliding clutch, splined to the transmission shaft. The name synchro-mesh refers to the automatic action of making the sliding clutch and the gear, with which it engages, revolve at exactly the same speed just prior to the actual engagement of gears, so that no clashing can occur at any speed. The getaway speed is increased, and a factor of safety is introduced in enabling the driver to shift from high to second gear instantaneously for braking purposes. The synchronizing mechanism is applied only to second and high speeds, as it is not required for low or reverse, where the shift is usually made while the car is standing still.

The Buick transmission is a representative synchro-mesh unit. The synchronizing mechanism consists of two friction clutches, made up of a cam sleeve having two internal cones, one at either end, which contact with external cones on the intermediate and high-speed gears. This cam sleeve surrounds the sliding gear clutch, and is in turn surrounded by the shifter sleeve, which is operated by the shifter fork. The cam sleeve is rotated about the main shaft along with the sliding gear clutch, by means of three spokes on the clutch which pass through slots on the cam sleeve and fasten to the shifter sleeve. Between the spokes on the sliding clutch there are six poppets, which engage a circular groove on the inside of the cam sleeve. These exert a pressure on the groove sufficient to move the cam sleeve forward and backward with the shifter sleeve until contact of the cones occurs. Further movement of the sliding clutch causes the poppets to compress and leave the groove, so that the gear on the clutch may engage with the required gear.

Figure 6 shows that part of the gearset involving the synchronizing unit, the balance being similar in design to the conventional type. In this diagram, *A* is high speed gear, *B* second speed gear, *C* the internal cones on cam sleeve, *D* the external cones on high and second speed gears, *E* the external gears on sliding clutch, *F* the shifter sleeve, *G* the cam sleeve, *H* one of the spokes on sliding clutch, and *J* one of the poppets. In neutral position, cones *C* and *D* are slightly separated. There is a minimum end play for the assembly of 1/8″ and maximum of 3/16″ total from cone to cone engagement. Less than 1/8″ is liable to cause drag between friction cones, producing gear noise in neutral, and greater than 3/16″ may produce gear clash in changing.

Figures 7 and 8 illustrate the sequence of movements on going

into high speed. Assuming that the car is in motion, the shifter sleeve, cam sleeve and sliding gear clutch are revolving in unison, the clutch being splined to the mainshaft, and the spokes causing the cam sleeve and shifter sleeve to revolve with the clutch. Movement of the control lever causes these to move forward as a unit, until the cones come in contact, as shown in Figure 7. The poppets exert sufficient pressure on the groove in the cam sleeve to carry it forward with the shifter sleeve until the contact of the cones occurs. The two contacting cones then revolve as a unit, making the rotating speed of the sliding clutch and the high speed gear exactly the same. This is the synchronizing effect. Further movement of the shifter sleeve forces the poppets out of the groove, causing the spokes to move along the slots in the cam sleeve, until the sliding clutch engages the high speed gear, without noise or clash, as shown in Figure 8.

The sequence on going into second speed is similar, the sliding clutch moving to the rear in the same manner.

Some cars have used helical gearing along with synchro-mesh, thus adding quietness of operation in second gear to the noiselessness of changing gears. Recently synchro-mesh transmission has also been incorporated in some of the four-speed gearsets.

Free-Wheeling

Recently free-wheeling has achieved prominence in the automobile industry of this continent. Free-wheeling is really a modern name for the over-running clutches, which have been experimented with from time to time in the past. The principle of free-wheeling is very similar to the operation of the coaster-brake on a bicycle. The engine is enabled to drive the car, but is prevented from being driven by the momentum of the car. When the car travels at a greater speed than that caused by the rotation of the engine, the free-wheeling mechanism automatically breaks the engagement between engine and driving wheels, allowing the car to coast until engine and wheel speeds are again the same.

A number of different types of over-running clutches have been designed in the past, some an integral part of the transmission, some located between the transmission and the rear axle, and some incorporated in the rear axle. The inventor's intention in each case has been either to secure economy of operation or ease of gear shifting. Studebaker was the first automoble manufacturer on this continent to adopt free-wheeling as its standard transmission, in which it claims to have secured both of the above desired features.

The Studebaker free-wheel or over-running clutch, providing free-wheeling in high and second speeds, consists of a shifting unit splined to the mainshaft, which completes the gear connection for these speeds. High and second speed gears are of the helical type, the second speed gear being in constant mesh with its countershaft gear and free to rotate on the mainshaft. Reverse and low speed are similar to those of the conventional type of gearset.

Figure 9 shows the Studebaker free-wheel unit, mounted on the

mainshaft betwen the clutch or high-speed gear *B* and the second speed gear *J*. This unit consists essentially of three parts, *M* the inner cam, *N* the outer shell, and *O* the rollers.

Figure 10 shows a cross-section of the free-wheel unit. The three-lobed inner cam *M* is splined to the mainshaft, and has external teeth at either end, which engage inner teeth on high or second speed gear, when free-wheeling is not desired. The outer ring has internal teeth at either end, which engage with external teeth on high or second speed gear. There are three sets of four rollers each, graduated in size to conform to the cam profile, which is a true arc of a circle. When the engine is driving the car using free-wheeling, the drive is the outer shell, rollers and inner cam to the mainshaft, the rollers wedging in the smaller ends of the openings and locking outer shell and cam together. When the car speed exceeds the engine speed, the cam rotates at a higher speed than the outer shell, carrying the rollers to the large ends of the openings. The rollers disengage, and the cam is free to rotate independent of the outer shell, until the car speed drops to that of engine or the engine is accelerated to car speed, when rollers are again forced to the narrow end of openings and engine drive is resumed.

Figure 11 shows the gearset after having been moved into free-wheeling high speed. The free-wheel unit has been moved forward on the mainshaft until the internal teeth on the clutch outer shell engage the external gear which is rigidly mounted on the high-speed gear. The clutch is prevented from moving too far forward by a latch on the shifting lever. In this case the path of the power is from the high speed gear through the outer shell, rollers and inner cam to the mainshaft.

When free-wheeling is not desired, as when using the engine for braking purposes, a button on the gear shift lever releases the latch mentioned above, and the unit can then be moved further forward until the external gear on the inner cam engages the internal gear on the high speed gear, giving conventional drive. Figure 12 shows the gears in this position, in which case the path of power is from the high speed gear through the inner cam to the mainshaft.

Second speed, free-wheeling or conventional, is obtained in a similar manner, by moving the unit to the rear on the mainshaft.

It is claimed that a saving of 12 per cent. on gasoline consumption and 20 per cent. on oil consumption can be effected with free-wheeling. This reduction is due to the fact that, frequently while free-wheeling, the car will be travelling at a relatively high speed, while the engine is idling. Free-wheeling also reduces carbon formation, decreases the strain from reversional stresses on the driving mechanism, and increases tire life.

Tests were made with two identical Studebaker cars, one operating with free-wheeling, the other with a conventional drive. The method of drive was interchanged on alternate days, in order that no factor might enter the results due to variation in characteristics of engine or operator. The tests covered about 5,000 miles over mountainous and level roads and in traffic. The results of these

tests showed an average decrease in gasoline consumption of about 17.5 per cent., and decrease in oil consumption of about 40 per cent.

The requirements of the brakes and generator are increased with free-wheeling, and hence their capacities must be increased slightly. It has been found that an increase in brake capacity of 20 per cent. is more than ample to take care of all free-wheeling conditions. In the above tests it was found that at high speeds less stopping time was required with free-wheeling than with conventional drive, but with low speeds and an average pedal pressure, the stopping time was increased about 15 per cent. Also during these tests, it was found that for mountainous and level driving the number of brake applications was increased about 15 per cent. with free-wheeling, but when operating in traffic the number of applications was about 10 per cent. less with free-wheeling than with conventional drive.

The increase in idling time of the engine, when free-wheeling, causes a decrease in ampere-hours charge from the generator, found from tests to vary from 5 per cent. to 15 per cent. decrease. A slight decrease in the size of generator pulley will compensate this loss in charging. The transmission gears and bearings benefit when free-wheeling, due to the elimination of coasting loads, which also benefits the propeller shaft, rear axle and tires. Gear noise is eliminated when travelling in second gear, and gear changes, from second to high and vice versa, may be made at any speed when free-wheeling.

The Hupmobile Free-Wheel unit is similar in construction. Tests were made on a number of trips with Hupmobile, using conventional drive on the outward trip and free-wheeling on the return trip. These tests showed an average decrease in engine revolutions of about 35 per cent, when free-wheeling, with consequent decrease in gasoline and oil consumption, and wear on parts.

Lincoln and Pierce-Arrow have also adopted a free-wheeling unit similar to that used by Studebaker.

The Plymouth Free-Wheeling transmission is similar in construction to that of Studebaker, except that it has three sets of only three graduated rollers. It is, however, mounted on the propeller shaft to the rear of the transmission, giving free-wheeling in all three forward speeds. Conventional drive is obtained by means of a control button located on the instrument panel, which cuts out the free-wheel unit. In reverse the free-wheel unit is automatically cut out. This same unit is optional equipment on Dodge and Chrysler cars.

The free-wheeling unit used on Willys cars is similar in operation to that of the Plymouth, being mounted to the rear of the transmission and giving free-wheeling in all forward speeds. It consists, however, of six single rollers acting in individual tapered slots between the cam surface and the outer sleeve. That used on the Willys-Knight is similar in design with ten single rollers. Figure 13 shows the free-wheeling mechanism of the Willys, which can be locked out by sliding gear *A* into mesh with the internal gear

of the free-wheel clutch to give conventional drive. Movement of gear *A* is controlled from the instrument board, and automatically when reverse gear is used. Figure 14 shows a cross-section of the unit. It will be noted that in this case the drive is in the opposite sense to that previously described, torque being transmitted from the engine through the splined shaft to the inner cam, and thence through rollers to the outer shell which is coupled to the propeller shaft.

The free-wheeling unit which is optional on Hudson and Essex cars is similar in construction to the Willys, but control of the lock-out gear is by means of a short lever just to the rear of the gear-shift lever. It has the added feature of a modulator, mounted on shaft to rear of the free-wheel unit, whose purpose is to take up any shock there may be when the engine resumes drive after a period of free-wheeling.

In the transmission of the Auburn car, they claim to have the advantages of all these designs for the betterment of gearsets. They have constant mesh helical gears, which give quietness of operation in both high and second speeds. They have a synchro-mesh sliding clutch, which assures ease of shift and absence of clash when changing gears. They also have a free-wheel unit, mounted on the propeller shaft to the rear of the transmission, giving free-wheeling in all forward speeds. The lockout gear is controlled by a short lever just to the rear of the gear shift lever. The free-wheel unit used on the Auburn is the L.G.S. clutch type.

The L.G.S. clutch is of simple construction, occupies a small space, and consists of three essential parts, a driving member, driven member, and connecting link. The driving and driven members are cylindrical in shape, and the connecting link is a helical spring, with its surface accurately ground to fit the inside of the cylindrical members. There are several types of L.G.S. clutches, but that usually adapted to automobile use is known as the ratchet type, in which the spring is normally a few thousandths of an inch larger in diameter than the inside of the other members. When the driving member is rotated in the opposite sense to the turns of the spring, the spring will increase in diameter due to friction, until it binds in the driven member, causing the latter also to rotate. When the driving member is rotating in the opposite direction, which is the relative effect when the driven member tends to rotate at a greater speed than the driving member, the tendency is for the spring to unwind to a smaller diameter, so that slippage will take place, power will not be transmitted, and the driving member will run free.

Figure 15 shows a diagram of the L.G.S. unit, in which *A* is the driving member, *B* the driven member, and *C* the connecting link. The lockout gear *D*, which operates by hand, for conventional drive and automatically in reverse, is moved forward until it causes driving and driven members to rotate as one.

An L.G.S. clutch has been designed for use on Ford cars, which can be mounted either within the transmission or between trans-

mission and shaft. This unit has a spring 2 1/8″ in diameter and 2″ long, with a capacity of 500 lb. ft. On tests of engine and wheel speed when mounted on Model A Ford, it was found that speedometer on propeller shaft registered 19.5 miles, while that mounted on transmission shaft registered only 16.5 miles, thus saving three miles of wear on the engine and corresponding fuel consumption.

The aim in practically all of the recent developments in transmissions has been for quietness of operation and simplicity of gear-changing. The maximum of quietness and ease of gear shift is rapidly being attained, and it is now forecast by some automotive experts that the next advance in design will probably be automatic transmissions. Several designs for this purpose have been invented, but are still more or less in the experimental stage. Electrical transmissions have been used in the past, where the gear-shifting was completely controlled by means of electrical switches, located either on the steering wheel or instrument board.

The Spontan Company of Sweden has developed a variable automatic transmission, which has neither clutch nor gears, its operation depending upon the centrifugal forces of two rotating weights acting on two overrunning clutches. It is claimed that the action is extremely smooth, and flexible at all speeds, besides being noiseless due to the absence of gears. There is only one pedal, which controls speed, applies the brake, allows the car to coast, and even reverses the direction of motion. Simplified operation and tested efficiency of 98 per cent. is claimed for it.

In Europe, hydraulic transmissions are coming into prominence. The Daimler Fluid Flywheel, designed in England, enables the car to start by merely depressing the accelerator and releasing the brake. On level ground the car can be left idling in high gear with the brake off and will not move. An ordinary clutch, smaller than usual, is still used for changing gears, but not for starting and stopping.

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Olds Motor Co.

ELECTRIC FURNACES

Condensed from a Thesis for the Degree of B.A.Sc. in Electrical Engineering

BY W. B. PROUDFOOT

The Electric Furnace

The electric furnace is one in which the heat is furnished by the passage of current through some form of resistance and in which the sole object in the use of the electrical energy is to produce the necessary heat.

The above definition does not include electrolytic cells such as those in which aluminum, calcium and sodium are made, as in these cells the office of the electrical energy is to effect an electrolytic separation only.

The electric furnace is operated by either direct or alternating current, depending on which is most convenient and suitable, and any reaction taking place within the furnace is pure heat reaction. Electrical energy, therefore, is considered solely from the standpoint of its properties as a source of heat.

There are three general types of electric furnaces:—

(1) The resistance furnace, in which the heat is generated in a solid medium.

(2) The arc furnace, in which the heat is generated in an arc between electrodes.

(3) The induction furnace, in which the charge consists of conducting material which forms a closed circuit around a laminated iron core, heat being generated within the charge by currents induced in it by a primary coil.

Electric Heat-Treating Furnaces

There are few fields which present more varied problems than the design of heat-treating equipment. The field is perhaps primarily mechanical engineering, in that furnace design involves the conservation of heat and the design of mechanical apparatus, but the electrical problems, such as the economical application of power, the improvement of load, and the selection of automatic electrical apparatus are indeed varied and complicated.

Electric furnaces are equally adaptable to large tonnage operations, as a uniform heat distribution can be maintained over an area of 2000 sq. ft. as readily as 1 sq. ft. Improved methods of handling by automatic means both inside and outside the furnace, have been responsible to a large extent in the increased use of electric furnaces in the heat treatment of large castings.

The earlier types of electrical furnace were the box and car types, the small pusher type of furnace, being the only exception. The one main disadvantage of these furnaces was overcome by the introduction of the continuous furnace, namely, the difficulty of obtaining a satisfactory heating speed.

The absorption of heat by a solid body is very rapid, but the rate of absorption decreases rapidly as the temperature rises.

The old type of furnace had to be powered high enough to supply heat throughout the whole heating operation at the initial absorption rate. The continuous type furnace is divided into zones so that each zone supplies the amount of heat required by that particular cycle.

When the process is best handled by the batch type furnace, the improvement of handling mechanisms and the adaption of furnaces to the most desirable temperature cycles have made increased production possible.

In the field of annealing the counterflow recuperative type of furnace is widely used. A large saving in power is accomplished by recovering a part of the heat radiated and using it to pre-heat additional stock. This type of furnace is widely used in annealing gear blanks, engine cylinders, cast iron parts, and miscellaneous forgings.

The rate of heating is, however, relatively slow, and as a result special normalizing treatments cannot be carried out in the recuperative furnace.

Carburizing of steels can be accomplished in the continuous type furnace but a more uniform product results from the use of the recuperative furnace. By the use of two different speeds of travel in the two directions, it is possible to take care of several classes of work in one furnace.

For the heat treatment of finished parts much smaller equipment is in use. For example, in the hardening of ring gears in the roller hearth furnace, a 75 kw. furnace is the maximum size in use. Very little distortion occurs in spite of the rapid heating and handling.

For many years the problems in the design of conveyor furnaces could not be solved. The expense of heating a heavy container several times during the heat treatment of a single charge or casting was prohibitive. A light flexible conveyor of a slow cooling material, and better design of heating elements, have to a large degree solved the difficulty.

In steel foundries, the car type furnace in which the material is conveyed into the furnace in a car, usually by automatic means, is widely used. Box type furnaces are used in certain foundries for the heat treatment of large castings.

The largest electric furnace ever built is of this type. It is over sixty feet long and weighs over one hundred and fifty tons. It is remarkable that in such a furnace even heat distribution is readily maintained.

Pit type furnaces have been designed to compete with the fuel-fired furnace in alloy steel work. Rapidity of melting and a much purer product are the advantages claimed, but these furnaces are in operation only in localities where power rates are relatively low.

Heat treatment of pure aluminum and aluminum alloy castings in the electric furnace is the only satisfactory method in use to-day. The alloys of aluminum must be heated to within a few degrees of

1000°F., but overheating of only a few degrees will render the article being heated practically useless. Even heat control in the electric furnaces enables the operator of the furnace to maintain the required temperature for any given period.

The above applications of the electric furnace in heat treatment are widely used, but the possibilities in this field have been only faintly realized. As competition in industry increases, improved design of electric furnaces is certain to result, and the future of electric furnaces in heat-treatment is assured.

Steel Melting in Induction Furnaces

During the melting period the old type of furnace due to very heavy loads of a fluctuating character caused serious voltage surges in the supply lines. Reactance introduced to offset this caused a poor power factor, so that heating by eddy currents is now in more general use.

Its advantages are:—

(1) Absolutely steady load with no voltage fluctuations.
(2) Unity power factor.
(3) Heat is produced in the steel itself and radiation is reduced to a minimum.

The induction furnace is now "coreless" and is usually run at frequencies which vary from 2200 to 2000 or more periods per second. These frequencies are by high frequency alternators or spark gap and valves with oscillation transformers.

The general equipment necessary to operate a coreless induction furnace includes a supply of high frequency power, a water-cooled induction coil in the centre of which is the crucible and a bank of condensers in parallel with the furnace, for power factor correction.

This furnace, due to its magnetic action, produces a very homogeneous steel, and the loss due to escaping volatiles is minimized.

Industrial Electric Heating

Industrial Heating loads are undoubtedly very desirable additions to distribution systems but it is a difficult problem to demonstrate to possible consumers the advantages of electric heating, due to the fact that every application is met by some unique local condition.

The methods of employing electric energy for industrial heating are diverse, as is readily seen by the arc and resistance methods, both of which are subdivided into many varieties.

The method commonly adopted is indirect heating by resistances. In this method temperature regulation is quite simple, with the result that it can be readily applied to the requirements of different operations on different products of the same factory which require various heat-treatments.

The total energy used is absorbed in three ways:—

(1) Heat actually necessary for the process in question.
(2) Heat absorbed in raising the temperature of the oven or appliances.

(3) Heat lost by radiation or convection.

The first includes the heat necessary for the trolleys, containers, chemicals, etc., and is entirely lost in each treatment; the second varies considerably, depending upon the periods of stand-by necessary, and the third is dependent on the original design of the appliance.

The wages bill for heat production is a minimum, as time is required only for switching and temperature regulation. Costs of handling are diminished rapidly, as the charge is kept at a suitable and constant temperature quite readily.

The facility of exact temperature regulation affects running costs, the advantage secured being rapid heating of objects under treating, resulting in increased output, with less radiation losses and smaller labour charges.

Of special interest is an investigation of the rate of heat penetration into bodies of large surface compared to their edges. It is known that heat permeates solid metal bodies slowly, and a test on a 4″ armour plate showed that while it only required one hour to raise the temperature of the central plane to 500°C., it required 10 hours for the surrounding temperature of 900°C. to be reached at the central plane.

Thus it is seen that if 500°C. is a high enough temperature for the treatment, this can be reached in one hour, with surprising time economy and without risk of over-heating, by using a 900°C. surrounding temperature.

Other working costs involved are those of actual loss of material, value of rejects and the expense of finishing the output. The material losses are chiefly due to oxidation which may in the case of finely divided material, like wire or sheet metal, amount to a large percentage. Rejects, especially in the case of semi-finished articles, may be valued far in excess of the amount recoverable from the scrap.

Distortion of form and other imperfections prevalent in a flame-heated oven can be corrected, but at a considerable expense. Costs of this type are very low with electric heating.

The decreased depreciation of the electric furnace of the resistance type should be considered. Since the upper temperature limit is easily controlled, the expansion strains are few. Electric heating elements, as a rule, have a long life, and the switchgear in connection with the furnace is only used intermittently.

Consideration should also be given to the power used in manipulating loads, and in opening oven doors, and to the reducing gases and hardening compounds necessary in practically all heat treatments. Recent figures favor the electric furnace.

An example of the relative cost of a solid fuel-heated and an electric oven used in an identical capacity, namely, the case-hardening of gear wheels, showed that for the fuel-fired oven the rejects raised the cost of the product 9 per cent., while maintenance costs were eight times as great as in the electric furnace. Added to

VERTICAL SECTION

HORIZONTAL SECTION A-B

this was the fact that the entire electrical plant required only one-half the space taken by the fuel oven.

The oven space of a furnace must be entirely utilized, and the best sequence of operations must be planned, if efficiency and low working cost are to be secured.

The effect of securing the highest percentage of filling, the most rapid sequence of operations and the minimum number of temperature changes is shown in the following table:—

	Consumption in Kw.H.		Savings	
	Before	After	K.W.H.	Percentage
Loading A.....	7990	4894	3096	38.8%
Loading B.....	7040	4521	2512	35.8%

The monthly saving in the above example was found to be 12000 kilowatt-hours.

From the above discussion it is evident that electric heating is of advantage both to consumer and supplier of energy. Careful study, and careful use of the appliances will secure greater economy, and the improvement of products will result in increased sales.

A 100,000 Ampere Electric Furnace

In the manufacture of carbide and ferro-alloys the efficiency of an electric furnace must be very high to make the process profitable. It has been found that extremely large furnaces, with a reduction in the number of electrodes is the solution to the problem.

A recent 100,000 ampere furnace installaion in southern France is a noteworthy example. Two figures of the furnace proper are shown on the opposite page.

This furnace has a 7′-6″ diameter carbon electrode, 4′-0″ in height. Current is carried to this electrode from four 50-cycle transformers by a number of bronze, water-cooled conductors in parallel, which tends to offset self-induction effects and give a high power factor.

The furnace is very interesting from a construction viewpoint. It is made of ferro-concrete, and is perfectly air and liquid tight. It takes the form of a star-shaped polygon, with a chimney at each of the star points. Cooling is effected laterally and below by water coils.

The furnace is used in the manufacture of carbide, ferro-manganese and ferro-silicon, a total of 3250 Kw.H. being consumed per ton of carbide. The furnace has been operating continuously for two years and has proved very satisfactory in all respects.

Inductor Coils for the High Frequency Furnace

Despite the qualities of the high frequency furnace, such as carbon-free melts, rapidity of heating and economy of power consumption, it was learned that each different melting process required care in bringing the proper relation between the inductor and the furnace charge. In the design of furnace coils to meet the above requirement the following principles must be considered:

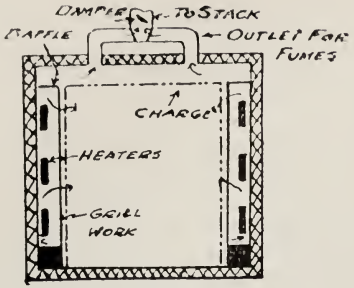

FIG 1.

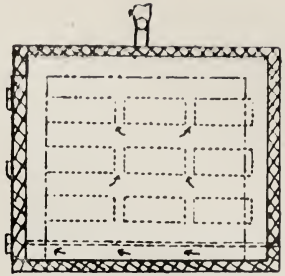

FIG. 2.

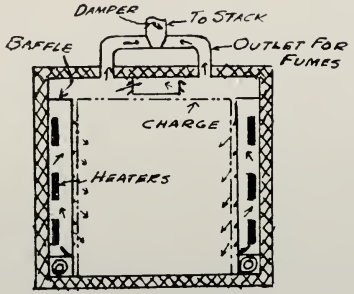

FIG. 3

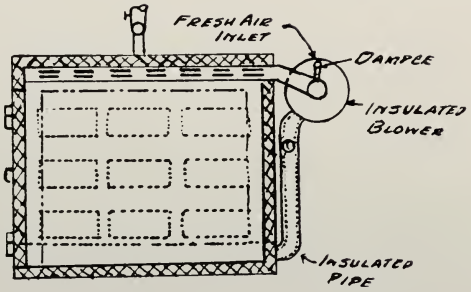

FIG. 4.

(1) Number of ampere-turns must be a maximum.
(2) The inductor must be water-cooled.
(3) Voltage applied determines the insulation necessary between coils.
(4) Concentration of the magnetic field induces a higher temperature.
(5) A certain amount of heat insulation between the object being heated and the water-cooled coil.

The amount of insulation necessary is not calculable but a few tests readily made will result in the correct design.

In experimental work it is important that the conditions outlined above be followed. The resulting inductor coil will prove a valuable aid to scientific investigation in the melting of metals.

Industrial Electric Heating

It is often necessary to have a movement of air or some particular gas through an electric furnace, for some purpose, such as the oxidation of the charge.

The difficulty of using convection is that passages must be provided through the charge. This requires a proper arrangement of the pieces of the charge and the correct arrangement of baffles.

The diagrams below illustrate the principle of the heating chamber of a core-baking oven. In the treatment of cores, air is required for oxidation of the cores and for ventilation.

Figures 1 and 2 show the arrangement for natural draft, and figures 3 and 4 illustrate forced convection by fans.

The advantages of heat transfer by convection are:—
(1) Flow of heat is independent of the suface of the material.
(2) Rate of heat flow can easily be increased.
(3) Convection heating and ventilation aid each other.

The disadvantages are:—
(1) Difficulty of providing proper channels for heat distribution.
(2) Effectiveness of convection becomes less and less as the size of the heating chamber is increased.

Electric Cast Iron Melting Improves Production

Reduction of iron ore in the blast furnace results in a metal not more than 92 per cent. pure. An increasing market for higher grade cast iron, due to competition of cast, stamped, plate and welded steel, has led to an increased use of electric furnaces in this field.

Pioneer work in the production of cast iron by electric furnace was carried out by the Luckenheimer Steel Company. Conspicuous improvement in the tensile strength and grain structure of cast iron led to the introduction of the modern "Lectromelt Furnace."

Fuel-fired furnaces competing with a furnace of this type in a test on certain complicated patterns gave such serious shrinkage trouble that four out of five castings were scrapped, while five out of five castings from the electric furnace were usable.

Absolute temperature control in the electric furnace in cast-iron production cannot be equalled by any fuel-fired furnace, as any desired temperature can be maintained without danger of superheat.

Electric melting facilitates control of chill in very small castings, so that cast-iron castings are machineable at high speed without annealing. Developments of this type suggest an investigation of the Brinell test as a measure of machineability.

Electric Furnaces for Castings and Ingots

The development of a satisfactory electric furnace for making ingots and steel castings was long delayed due to the foundation requirements and clearance restrictions.

One of the recent furnaces overcoming these difficulties has a capacity of 7-15 tons. It is equipped with three 17″ diameter electrodes each supported by a counterbalanced mast arm which is independent of the furnace. The electrodes are each operated by a motor which automatically raises and lowers the electrodes as the heating cycle requires.

This furnace is of the rolling-rocker type and is easily handled for pouring operations. Current from a three-phase supply at melting voltages of 170-160-150—110 volts is carried to the furnace by 24 $6 \times \frac{1}{4}$″ copper bus bars. Probably the most important electrical feature of this furnace is a peak load limitator which limits the few excessive peaks, occurring monthly, any one of which would establish the monthly demand charge.

This feature is a remarkable means of saving many dollars, and as it improves load factor, it is approved by all central stations.

Industrial Heating Load Development

Industrial electric heating has been established as the most economical method in modern history.

Central stations of the United States have been cultivating this type of load for some time. Development of electric heating in Canada has been slower, but as power rates have dropped considerably, the electric furnace is becoming more prominent in Canadian industry.

It can be used economically in the following processes:—

(*a*) Melting tin, lead, solder, type metal, and brass.
(*b*) Melting wax, paraffin, tar, pitch and compounds.
(*c*) Hardening and tempering processes.
(*d*) Melting and annealing of steel and iron.

The revenue resulting from this type of load is very high, a 7000 Kw. load at 1c per kilowatt-hour, results in an annual revenue of $300,000.

In Canada, the largest users of the electric furnace to date are the newspaper companies, who use energy to melt stereotype metal, but various foundries and steel companies are realizing the economy of electric heating and are installing electric furnaces to meet the ever-increasing competition in modern industry.

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THE ACTIVATED SLUDGE PROCESS

Extracted from a Thesis for the degree of B.A.Sc. in Civil Engineering

BY J. G. POWELL

The Nature of Decomposition in Sewage

Sewage may be defined as the liquid wastes conducted away from residences, buildings, institutions, industrial establishments and other public buildings, together with such ground and storm waters that pass into the sewerage system of a community. Sewage contains almost every kind of waste matter, faeces and other domestic sewage, manufacturing waste waters containing alkaline or acidic substances, slaughterhouse wastes, tannery wastes, paper and rags, and numerous other matter that reach the sewers. These matters because of their high rate of decomposition, give rise to objectionable conditions. The essential factor in the decomposition of sewage is the presence of bacteria which thrive in countless numbers in the sewage. These bacteria feed on the sewage and bring about the conversion of the offensive waste products into simple chemical compounds. As the sewage, the food supply of the bacteria, is chemical in nature, and the changes brought about by the bacteria give rise to other chemical compounds, the process of decomposition is termed biochemical.

There are two types of decomposition, the oxidizing type brought about by the aerobic bacteria in the presence of oxygen, and the putrifying type, brought about by the anaerobic bacteria which thrive only when there is no oxygen present. The basis of the activated sludge process is the maintenance of conditions in which the aerobic bacteria can thrive.

Theory of Process

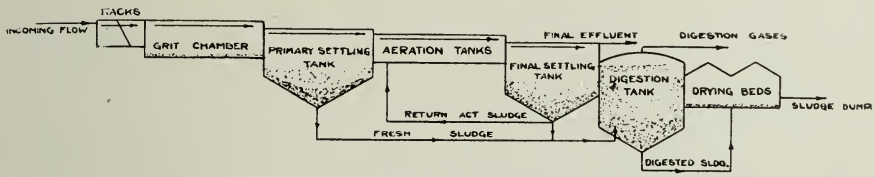
Activated sludge is first obtained by passing sewage through an aerating tank for a sufficient length of time to permit the organic solids and the colloidal substances to collect into sponge-like particles of floc containing countless numbers of aerobic bacteria, hence the floc has been called activated sludge. This floc is removed by settling in a clarifying tank, and then returned to the raw sewage, entering the aerating tanks. Here the floc sweeps through the sewage, absorbing the organic and colloidal matter in its sponge-like structure. The bacteria contained in the floc feed upon this collected matter, partially oxidizing it and restoring and increasing the faculties of absorption to the floc, so that it may be again returned to the entering raw sewage.

General Process

The following sketch (Fig. 1) illustrates a typical arrangement of an activated treatment plant:

The preliminary treatment, consisting of screens, grit chambers

and settling tanks, is necessary to convert the sewage into a condition most suitable for activation in the aeration tanks. Following the activation process the final settling tank is necessary to produce a clear effluent and collect the activated sludge of which a part is returned to the process and the remainder drawn off for digestion. Separate sludge digestion tanks and glassovers are shown, as this final method of sludge treatment is at present generally practiced.



DIAGRAMMATIC SECTION OF A COMPLETE ACTIVATED SLUDGE PLANT

Screens

Coarse floating matter such as paper, wood, hair and uncommuted fecal solids are readily removed by screening. The removal of these matters insures the proper operation of pumps, air-lifts, valves and pipe lines, and prevents the formation of unsightly scum on the settling and aeration tanks.

When the sewage is of a domestic character, coarse screens or racks consisting of parallel bars are all that are necessary to take out this unwanted matter. The rack is generally set in a separate channel leading to the grit chambers. It is inclined or curves in the direction of the flow, so that a larger area of the rack will be exposed to the incoming sewage. The bars in the rack are spaced from ½ in. to 1½ in. apart, depending on the requirements of the rack. The material collected by the rack may be readily removed by raking. Hand raking is usually all that is necessary, but in some sewage-treatment plants the quantity removed is too large for this method and mechanically operated rakes, automatically controlled, are used.

If it is desirable to remove certain materials from the sewage which would not be removed by the racks, a fine screen must be used. Hair from tannery wastes is very objectionable to the process; it not only makes the settling and the aeration tanks unsightly by clinging to the walls and the stirring mechanism, but seriously interferes with the digestion process by forming a tough heavy floating scum in the digestion tanks. Several types of screens have been designed to remove such matter, all of which are either mechanically or self-cleaned. The screens are commonly made of manganese bronze to withstand the action of the organic acids in the sewage. The openings in the screen are made less than one-quarter inch across, so that the loss in head due to them is very appreciable and must be carefully considered before installation.

The material collected by the screens and racks must be

promptly disposed of, either by burying or burning, as it contains organic matter which quickly becomes offensive.

Grit Chambers

Sewerage systems, especially combined systems, collect a large amount of grit, such as cinders, sand and gravel. This material, washed past the catch basins during a storm period and even in time of normal flow, is allowed to enter the treatment process proves very harmful. Channels clog up with it and it is injurious to pumps, air-lifts and other mechanisms, and tends to settle down on the diffuser plates. This necessitates a larger volume of air to keep the diffuser plates clean and the floc from settling.

Grit chambers are tanks designed to remove this grit from the sewage without taking out the organic matter at the same time. The factors affecting the design of grit chambers are chiefly:—

(1) The velocity of flow and method of obtaining it under variable conditions.

(2) The detention period.

(3) The method of cleaning the chamber.

The velocity of one foot per second is generally used for the normal rate of flow in the chamber, as it allows for the settlement of the heavier solids with a minimum amount of organic matter. The presence of excessive quantities of organic matter in the grit sets up septic conditions in the chamber and on removal it may become extremely offensive. The velocity fixes the cross-sectional area of the chamber. Common depths of the chamber are from 2 ft. to 4 ft. The detention period, usually one minute, fixes the length of the chamber. The shape of the chamber usually depends on the method of cleaning it. Hand-cleaned chambers should be wide enough for workmen to shovel them out, while mechanically cleaned chambers must be of such dimensions as to accommodate the cleaning apparatus. A weir is used at the outlet to maintain the best conditions for settlement.

Clean grit collected in this manner may be readily disposed of by spreading it over the ground or by burying it.

Primary Settling Tanks

Activated sludge is supposed to digest much more rapidly if mixed with raw sludge. The primary settling tanks provide a means of obtaining this raw sludge. Also the amount of air required per gallon of sewage in the aeration process may be appreciably decreased if the coarse solids are removed before the sewage enters the aeration tanks. The detention period must be made as short as possible, consistent with the removal of required sludge so that sewage may be kept fresh and thus readily oxidizable.

To permit the prompt removal of the sludge from the tanks, there are two types of mechanism, the rotary and the tractor. The rotary type is so called because it consists of a set of horizontal arms to which scrapers are attached, which revolves on an axle mounted in the centre of the tank. The settling tanks are square with the

inside corners filled in so as to round out the bottom of the tank, and thus bringing the whole bottom of the tank within reach of the scrapers. The bottom of the tanks is sloped toward a central collecting well. The scrapers hanging slightly above the bottom and extending to the edge of the tank, slowly revolve, and gently push the collected sludge toward the centre of the tank where it may be drawn off as required.

A small electric motor housed on the centre of a truss-like superstructure spanning the tank, rotates the scraper through a set of reduction gears.

The tractor type operates on much the same principle as the rotary type, except that the power is differently applied. A small motor-driven truck running on a track encircling the tank is connected to the verticle axle at the centre by a horizontal arm and as the truck moves around the edge of the tank it rotates the scraping apparatus.

Either of these types prove very satisfactory. Where the settling tanks are very large the tractor type is usually employed. It requires a little extra care in winter as the track must be kept free from snow and ice.

The sewage enters the tanks through either submerged or baffled ports which ensures even distribution of the influent. The sludge is drawn off from the central collecting well in the tank bottom. The effluent sewage passes over a carefully levelled weir and is taken to the aeration tanks.

Primary sedimentation is often omitted and the whole of the sewage treated by the activated sludge process, as at Milwaukee.

Aeration Tanks

In the diffused air aeration method of activation there are three main functions for the air to perform:—

(1) It should supply enough oxygen to maintain aerobic conditions which are necessary for the growth of the oxidizing bacteria.

(2) It should thoroughly and continuously mix the activated sludge with the incoming sewage so as to ensure a uniform action throughout the tank.

(3) It should prevent the settlement of solids in the aeration chamber which would start up septic conditions.

These functions are all necessary to establish a well oxidized and a good activated sludge.

The aeration tanks are divided into several connected longitudinal channels, so arranged to give a maximum length of flow to the sewage in the tank space available. The tanks vary from 6 ft. to 15 ft. in depth, never being made much deeper as the power required to produce the compressed air for aeration varies as the depth of the tank.

There are two types of tanks used, the ridge and furrow type and the spiral flow type. In the ridge and furrow tank, diffuser plates are set in furrows at right angles to the direction of flow, submitting the sewage to air baffles which maintain a high rotating

velocity in the sewage. In the spiral flow tanks, the diffuser plates are placed in the flat bottom along one wall of each channel. The air from the diffuser plates as it rises causes a rotary motion in the sewage which combines with the horizontal velocity of the sewage to form a spiral or helical motion throughout the tank. This latter type is usually adopted as it permits a longer path of travel of both air bubbles and sewage. These spiral flow type of tanks are also much easier to construct as the form work for the concrete is much simpler. Care should be taken in the design of the tanks so that a smooth flow is provided in the channels. Nicks and corners should be rounded off so that the flow may scour the walls and bottoms of the channels, keeping them free from any settlement in which septic action would commence.

Only a small proportion of the air used in aeration is absorbed by the sewage, the remainder is used to develop the churning motion in the sewage which continually brings fresh material in contact with the activated sludge. The air diffusers used should meet the following requirements:—

(1) The diffuser plate must introduce the air to the sewage in a finally divided state so that it may readily be absorbed.

(2) They must offer the least resistance to the air passing through it as possible, in order to cut down power costs.

(3) They must be made so that they may be readily taken out of the tank and cleaned and replaced.

The most common type of diffuser is the porous cement plate, made from a specially prepared mixture of cement and quartz cast in iron holders.

Before the effluent from the primary settling tanks passes into the aeration tanks, activated sludge is mixed with it in a separate chamber. The volume of activated sludge introduced is generally equivalent to 20 per cent. of the volume of the incoming sewage. This mixture gives best activation conditions, though a lesser volume may be used if not below 8 per cent., depending on the characteristics of the sewage. Below this there is a marked decrease in the purification of the effluent.

The period of aeration depends primarily on the properties of the sewage. For instance, an average domestic sewage may become properly activated in from two to four hours, while a strong sewage containing industrial waste may require from six to eight hours of aeration. It is also dependent on the extent of purification required in the effluent, as a highly nitrified effluent requires a much longer period than an effluent which is merely clarified.

The quantity of air required also depends on the character of the sewage. Only from 5 to 10 per cent. of the air supplied to the sewage is used to maintain aerobic conditions, the remaining air being necessary to maintain a sufficient agitation throughout the sewage. If the air supplied falls much below one cubic foot per gallon of sewage the diffuser plate will become clogged with settlement. Therefore, the quantity of air employed varies from one cubic foot per gallon for a weak domestic sewage up to as high as six cubic feet per gallon for a strong industrial sewage.

Final Sedimentation Tanks

The liquor from the aeration tanks must be passed through final settling tanks to remove the activated sludge and leave a clear, final effluent. These tanks are very similar in design to the primary settling tanks. It is essential that the activated sludge be removed either continuously or at frequent intervals.

The activated sludge particles are extremely light, the slightest currents preventing them from settling. Therefore, the inlet to the settling tank must be properly baffled so that the velocity of

Activated Sludge Plant at Leaside

the entering sewage be kept lower than the settling rate of the suspenced activated sludge particles. The horizontal velocity of 2½ ft. per minute should not be exceeded. As an aid for this condition, long carefully levelled effluent weirs are used to allow the clear surface liquor to be skimmed off at a uniform rate. The detention period generally adopted is about 2 hours, based on the average daily rate of flow.

Final settling tanks must be of sufficient depth to allow for the fluctuations in the height of the activated sludge accumulated on the tank bottom. This may vary greatly during the day depending on the quality and quantity of the sewage treated, because the sludge is drawn off at a uniform rate. It is therefore necessary to

provide ample storage for this collected sludge to prevent it building up and being carried out in the effluent.

The sludge should be continuously removed from the tank to prevent fermentation, which if allowed to take place causes the sludge to become colloidal and bulky within a few hours. This fermented sludge requires a great deal more oxygen when reintroduced into the aeration tanks, and does not readily settle. Part of the sludge so removed is returned to the aeration tanks, the remainder is mixed with the raw sludge and taken to the digestion tanks. In some cases the excess activated sludge is run into the primary settling tanks and drawn off with the raw sludge. This tends to lubricate and make the sludge easier to handle.

The effluent from the final settling tank will be clear and will contain considerable free oxygen if the process has been properly carried out and may be discharged without danger of nuisance into any body of water.

Miscellaneous Features of Design

Meters should be provided for measuring the flow of the sewage, sludge and air to the various units of the plant as they materially assist in the most effective and economical operation of the plant. The Venturi type of meter is the most satisfactory for this work.

Adequate drains should be provided for all portions of the plant so that any portion of it may be readily drained to permit inspection and repairs. Cleanouts should be provided throughout the system to ensure the proper operation of the drains.

Valves should be placed so that the flow of sewage, sludge and air to the different units may be controlled.

RECENT WORK IN THE SCHOOL OF ENGINEERING RESEARCH

The School of Engineering Research is an organization within the Faculty of Applied Science and Engineering for the purpose of training graduate students in the methods of research, and for the investigation of problems relating either to specific raw materials, industries, and engineering methods, and having some definite practical end in view, or to general principles of a purely scientific character. Research assistants are appointed annually in the various departments of the Faculty to carry on the work of research under the direction of members of the staff.

Since the inauguration of this research movement in 1917, it has exerted a very beneficial and rapidly increasing influence upon the work of this Faculty, both graduate and undergraduate. Eight bulletins, containing the results of 127 investigations, have been published, and Bulletin No. 9 is now in the press.

Viewed solely as an organization for the accomplishment of useful research, the success of the School has been distinctly encouraging. Desirable and stimulating as is the realization of positive results from research effort, an adequate appraisal of the benefits accruing from the School of Engineering Research must also embrace the more intangible and less easily discernible influences exerted upon students and staff.

With the continued generous financial support of the President and Governors of the University, the friends of the School hope for, and confidently expect, a still greater stimulation of interest in research among students, which in turn should lead to more varied and valuable research accomplishments.

Following is a brief statement indicating the nature of the research work which is, or recently has been, in progress in the various departments of the Faculty.

Department of Civil Engineering: Municipal and Structural

During the past decade a number of investigations have been carried on in connection with various problems in Civil Engineering. The late Professor Gillespie made some careful studies of the Imhoff tank for sewage disposal, and also conducted valuable researches in the use of reinforced concrete as a structural material. The present members of the staff have devoted a great deal of attention to various problems arising in the design of steel structures, two of which are still in progress. In view of the uncertainty as to the necessary strength of struts or ties for the purpose of staying columns against lateral buckling, nineteen 20-ft. laterally supported steel columns of I-section varying in width from 6 to 15 5/8 in. have been tested to destruction in the laboratory of the Department during the past two years. Since the 200-ton testing machine was built to accommodate columns less than ten ft. in length, a special apparatus had to be built to apply the load. Definite results have

been obtained and it is anticipated that new and reliable formulae will be set up for the designer.

A study of welded connections of steel beams has also been carried out, in the first instance by using 9-in. steel beams which were cut and connected to opposite sides of a central plate by connections of widely different types, the strength and rigidity of which was ascertained experimentally. Further experiments with 18-in. steel beams employing both welded and rivetted connections have been made, and useful principles have been discovered.

With the co-operation of the Department of Works of the City of Toronto, measurements of earth pressure on the deep sewers recently constructed in tunnel in the North Toronto system have been carried out by means of fourteen Goldbeck pressure cells placed on the outside surface. The results will be of value to the designer of deep sewers.

Work recently carried out by the use of the photo-elastic method and by the testing of a number of steel plates, has thrown new light on the subject of the effective net section of steel plates having rivet or drill holes in them arranged in various formations. A useful working formula has been devised for the rivet hole deduction.

Department of Mining Engineering

The work on cupellation losses and assaying has been continued. Specially designed apparatus and refined technique has aided in the development of important ideas and information in regard to the shape and other characteristics of cupels.

Last summer there was made in the Department a very important discovery in regard to the behaviour of seeds of the clover family and of the weed seeds associated with them. The separation of some of the weed seeds from clovers has been hitherto impossible of achievement. Development of the new discovery makes it entirely successful by certain ore dressing methods.

Work for several years has been progressing on certain fundamentals of gold milling. This year the studies have been with telluride ores and have succeeded in shedding entirely new light on the behaviour of tellurides in cyanide solution.

Department of Mechanical Engineering

In Mechanical Engineering research work has proceeded along several different lines, including hydraulics, heat transfer, measurement of fluid flow, steam engines and turbines and internal combustion engines, including the Diesel. In hydraulics, experiments have been made to determine the effect of water hammer in pipes, and the danger of bursting them by suddenly closing a valve; also on water turbines of the latest type, suitable for Canadian water powers, and on centrifugal pumps, experiments have been conducted to determine the effect of the height of the pump above the well, and other important details being examined.

A great deal of work has been done on the efficiency of hot blast heaters for buildings and also on the advantages, or otherwise, of the various types of heating radiators, much time having recently been spent in investigating the new style of copper tube radiator. In addition to this, a careful study has been made of Canadian and American-made insulating materials, such as beaver board, gypsum, etc., to see what value they have in the way of saving heat when they are used in dwelling houses and in office and other buildings. This type of work has been the subject of an extensive research and is still in progress.

In regard to engines of various kinds, much has been done and some of the results published. Studies on heavy oil engines have proved of much interest, and during the entire year graduate students have carried out a study on a small internal combustion engine.

Work on aeronautics, in which the wind tunnel is used, has also been done in a very extensive way and is still in progress, a graduate student being engaged all this year on an important investigation.

This research work has been carried out by the staff in Mechanical Engineering with the assistance of special research workers.

Department of Architecture

For some years past a study has been in progress of "The Early Architecture of Ontario", with a view to making a permanent record of old buildings which possess historical or architectural value. This record has taken the form of photographs and measured drawings. One result is that a nucleus for an exhibit of early Ontario architecture now exists in the Department of Architecture. This work is still in progress.

Department of Chemical Engineering

Some of the problems at present engaging the attention of members of the staff in Chemical Engineering have to do with

(1) The separation and properties of the lignosulphonic acids which are produced in large amount in the sulphite process for manufacturing wood pulp and are at present a waste product.

(2) The dry distillation of wood in vacua.

(3) The recovery of sulphur dioxide from waste smelter gases, for use in the paper industry.

(4) The catalytic production of elementary sulphur from sulphur dioxide.

(5) The prevention of corrosion of metal surfaces.

(6) The recovery of acetic acid from dilute solutions.

(7) The production of useful chlorination products as chloroform and carbon tetrachloride in good yield from natural gas.

(8) The catalytic transformation of natural gas into a mixture of hydrogen and oxides of carbon useful for the manufacture of methyl alcohol.

(9) Improved methods for the quantitative separation of zinc, copper and nickel from iron and aluminium.

(10) The determination of the best conditions for the production of acetone from calcium acetate.

(11) Improvements in the production of oxalic acid from wood waste.

(12) Purely scientific problems arising out of these industrial researches are also in progress, such as a study of the effect of organic compounds on the single potentials of a metal surface and an electrolyte in solution; the nature of the surface films on catalysts and how they function in adsorption and catalysis.

Department of Electrical Engineering

In the Department of Electrical Engineering considerable research and investigation has been carried out during the past few years, in the main as follows:

An analytical investigation of the calculation of operating characteristics of long transmission lines, extended to cover any alternating current network necessary for commercial transmission.

A further investigation to develop methods of rigorously calculating the operation of networks by convenient graphical constructions for easier solution of such problems.

A mathematical examination of present definitions of power factor, apparent power, reactive power, etc., under the most general conditions of non-sine waves and unbalanced loads, from which certain disagreements between definitions now in vogue may be removed by adoption of revised definitions and some new factors.

A much improved and quick method for calculating "attenuators" employed in telephone and other circuits to make possible high-quality transmission of speech and music.

A new instrument developed and constructed for measuring easily and quickly any frequency from 50 to 10,000 cycles per second.

Radio frequency amplifying circuits for broadcast receivers studied analytically and experimentally to explore the possibilities of "band pass" tuning so often claimed in advertising. Results and advertising do not agree.

A mathematical investigation of tuned radio frequency amplifying circuits to determine properties necessary for maximum amplification, in which a new and useful factor of merit for amplifying tubes was discovered.

A long investigation of calculated and actual properties of current transformers, resulting "Papers on Current Transformers" being in demand by engineers in Canada, United States, Mexico, England, Germany, India, Japan.

An automatic system for holding constant the frequency of electric generating systems, one form of a part of the apparatus having been in daily use for three years in the Electrical Labortories, holding constant the 25 and 60 cycle services for the laboratories.

For the National Research Council, Ottawa, another form of the above regulating apparatus for automatically controlling any air speed up to 170 miles per hour in their 600 h.p. wind tunnel.

The theory of automatic electrical control to constancy of temperature in rooms, and mechanism for the purpose, a difficult problem on account of the small heat storage capacity of air.

A theoretical and experimental investigation regarding minimum possible rate variations of electrically driven seconds clocks of highest grade, growing out of constructing the time system of the University.

Department of Metallurgical Engineering

A study has been made of magnesium aluminum silicates as refractory supports for heating elements used in electric heating appliances.

The main feature of this study was to obtain a material with a low coefficient of expansion and a low electrical conductivity in bodies which could be commercially processed and used for this purpose. The graduate who was engaged on this research is now employed by a company in the manufacture of such refractories.

Under way is a study of the relation between annealing temperatures and composition of cast iron. This involves many combinations of temperature with composition of cast iron and the work is still in progress.

Another investigation being carried on in co-operation with the Department of Physics, has to do with the rather recently developed use of the spectroscope adapted for the quantitative determination of very small amounts of impurities in copper, lead and zinc, more particularly since these metals have been made of such a high degree of purity that chemical analysis is not wholly satisfactory.

A study has been made, in co-operation with the Ontario Department of Mines of the refractory clays associated with the lignite deposits of the Moose River Basin.

The points considered were:

(*a*) Variation in quality of samples obtained from different localities.

(*b*) Care required in processing of these days clays due to the presence of organic matter.

(*c*) Suitability for the manufacture of building units, fire brick and general refractories.

(*d*) Blending with metallic oxides to obtain coloured bodies.

As a result several companies have asked the Ontario Government for permission to obtain these clays for commercial use.

At the request of an Ontario company experimental work is in progress on the manufacture of assay crucibles, using Ontario fire clays blended with imported clays. All the assay crucibles now used in Ontario are imported.

THE PRESENT ECONOMIC SITUATION IN CANADA—AND ENGINEERING

An address before the Engineering Society at its inaugural meeting, 19th October, 1931.

BY DEAN C. H. MITCHELL

In dealing with this subject let me endeavour first to present a picture of Canada as it was, say two years ago, during the period of prosperity. We could not then tell how long it would last, but bankers and economists were issuing warnings.

What grounds were there then for that expectation of prosperity? We have, first, Canada's geographical position, its physical features, and its climatic features. It can be expected that, as good Canadians, we could exercise the principles of "man's control," taking advantage of these and turning them to account. We had, next, Canada's advantages in natural resources, in agricultural, forest, mining, and industrial fields, from the production of which we can expect to profit for our own consumption and use for export. We next had the momentum, then at a high value, in the great volume of construction in buildings and in public works. We also had for our use the extraordinary facilities which had been built up in transportation and in water power for industrial uses. We had, above all, the great human assets and capabilities of Canadians already well tried in their physical qualities, their energy and alertness, their experience and resourcefulness and the confidence in themselves which they had acquired.

The next question to ask is, what has happened in these two years which have just elapsed? In how far have these happenings contributed to the present difficult conditions in which we now find ourselves, or in how far have they contributed, or are likely to contribute, to our future advantage following the present depression?

In agriculture there have been decreased crops, largely due to the drought; this decrease has been partly responsible for our decreased exports of wheat, but other factors have entered into this, due to the world's conditions, which have resulted also in decreased prices for Canada's wheat in the world's markets.

In forest resources, in the manufacture of paper for which Canada has become so notable, we are now suffering from the overconstruction of paper mills which was indulged in several years ago. Parallel with this has been the greatly decreased demand for our paper due to national and world conditions, and consequently decreased exports in what, a few years ago, was our second largest field of export.

In mining, on the other hand, there has been a considerable increase in gold production due to the increased demand for it following the gold situation in the world. Otherwise, in mining there has been a decreased demand in the basic production of silver, copper, nickel, etc.

In industries, generally, we have been suffering, like all other industrial nations, in over-construction, in too rapid mechanization, in over-production and in the widely decreased demand.

In construction, generally, there is, of course, a great curtailment in public and private building programmes. On the other hand the construction of public works has increased, due mainly to Dominion, Provincial and Municipal construction programmes designed for meeting unemployment.

In transportation there has also been a very great falling off in railway business, due to the decreased quantities of commodities of all kinds to be carried, and to a certain extent due to motor competition, both for passengers and freight. These decreases have been singularly indicated in the decrease in car loadings. On the other hand, there has been an increased use of the motor on the roads and highways for both passengers and freight. In water transportation there has also been decreased business as indicated by boat loadings, mainly due to decreased grain business. In the air there is a marked decrease; in fact, this mode of transportation never really got properly started.

In water power, for which Canada has become notable, the growing "demand curve" has been checked due to falling off in commodity production in the industries. There has, however, been a continued activity in the finishing of the installation of works previously projected and under construction and the momentum of these has been sufficient to carry Canadian activities in this field. New Hydro Electric Power works and extensions which were under contemplation have, however, been temporarily checked.

The consequent financial situation which has resulted from these conditions of decreased production, decreased exports, and decreased activities, generally, in so far as engineering projects are concerned, has had a mixed result. Our large favorable trade balance of two or three years ago—favorable with Great Britain and unfavorable in United States—has turned, in the last year, to unfavorable trade balance of considerable extent, although still favorable with Britain. There is a rift in the cloud, however, because for the past few months this unfavorable balance has been decreased and we seem to be heading for a possible favorable trade balance by the spring. Two or three years ago our dollar was being maintained at par in exchange but now with Britain off the gold standard, and our own general world conditions so unfavorable, our dollar is at a discount with United States; to-day it being only at 90. It is very gratifying, however, that our large volumes of bank deposits, both in savings and credit accounts of two years ago, are still being maintained, especially that portion in savings.

On the other hand, the large volume and extensions of bank credits during the great activities of several years ago, are now considerably reduced. The same may be said, but in a greater degree, in the volume of business and dealings in stocks which were so greatly inflated two years ago; a very marked shrinkage of stock

values and greatly reduced volumes of stock dealings are now a rule and the whole business in this field is greatly deflated.

The general situation has resulted in greatly reduced earning power in all industries. Western farmers are so put to it that they are unable to pay their debts, much less buy new equipment or even the ordinary necessities of life. Manufacturers cannot sell their products at a profit and doubtless many are carrying low inventories of manufactured goods and materials with which to manufacture. Costs and prices of all commodities have fallen and with this decline the cost of living, of course, has been reduced, probably 15 or 20 per-cent for staple foods, for instance. The former high cost of living has now disappeared; it was the lag between wages and rising prices which formerly made the trouble and now the reverse has occurred with adjustment of wages and prices unequal. The present low cost of living (food, etc.) has occurred more rapidly than has the reduction in wages. The significant thing in respect to this is that there is more distress than before. There is not enough employment to go around and what employment there is, is not steady. The governments and banks are endeavouring to support the dollar and not let it get too low; this effort may succeed, but we are doubtless facing a difficult time with respect to our exchange.

Further consequences of the general situation are manifested in the attitude of the people themselves. People are now only beginning to quit buying luxuries. On the other hand, people are beginning to be content with buying at home, in Canada. During the past six months the ratio of Canada's imports and exports has decreased over last year and consequently our balance of trade is rapidly tending toward the favorable side. For the last six months the ratio of our imports has fallen as from 514 to 318, and the exports from 433 to 295. During September imports are down as 87 to 45, and exports are down 81 to 49, so that there is already for the past month a favorable trade balance of four million dollars. People are saving and this is distinctly shown by the increase in savings deposits. The question may shortly be whether there will be such a large amount in savings deposits that saving in this manner may run to too great an extreme to be healthy for the general economic condition; on the other hand these large savings will be very useful when, before long, there will doubtless be large loans required by governments and municipalities to carry on during these difficult times, and the people themselves will have an opportunity to subscribe through their savings, whether individually, or through the banks or life insurance companies.

The people further are beginning—and just beginning—to realize that they must work, and work hard and long. This is not new however, for our Canadian people, and on all sides, the people are being encouraged and stimulated to keep up their old-time courage and not give way to pessimism.

In this respect note the recent address of the Prime Minister of Canada, and editorials in the press. In order to assist in these respects the governments, both Dominion and Provincial, have and

are continuing to give, direct aid to the western farmers and many of the people of the east are joining privately in this good enterprise. The governments in addition, Dominion, Provincial and Municipal, are undertaking needed public works to assist the unemployed.

The question now arises as to the engineering relation to all these features. One can only try to foresee the immediate results and appraise the value of engineers to the country at this time under these distressing conditions. Engineers are needed now almost just as much as in the prosperous times of a few years ago. This has been made manifest and is indicated by the very gratifying manner in which employment of engineers has been maintained during the last year. The steady progress of invention and applied science will continue in industry. Construction work will probably not be seriously abated but doubtless will change its character. Programmes for construction of public works will still further be laid out. Much work not under contemplation, while not being proceeded with, will probably be brought along to the stage of commencement primarily to meet unemployment and secondarily to encourage the development of the country.

The demand for engineers for these programmes and undertakings will therefore not likely decrease to any extent, but it must be remembered that the absorption of graduates in engineering from this university during the past three years has been very marked, and the best of it is that they are all staying in Canada to help in our development. The best advice I can give at this stage, in view of the foregoing, is that all of us, undergraduates and graduates alike, must work the harder to prepare for the turn of the tide toward the new prosperity which is bound to come before long.

THE CULTURAL ASPECTS OF DESIGN

Summary of an Address before the Engineering Society on November 18, 1931

BY G. M. WEST

Declaring that most people with technical training tend to follow their own line too closely, over-rating it and under-estimating others, Mr. G. M. West discussed the "Cultural Aspects of Design" in his very interesting address delivered before the Engineering Society on Wednesday, Nov. 18th.

Starting with the fundamentals of architecture, he showed how a structure may be balanced and proportioned so as to emphasize the desired portions. By the use of slides, buildings which did not appear "to have any purpose" were compared with better designs and their various faults and possible remedies discussed. It was pointed out that the same principles apply to the design of bridges and dams and that the engineer should be a "landscape gardener."

The speaker concluded his remarks by a tour of the campus, discussing the various buildings and commenting upon their continuity and individuality.

"THE CHALLENGE OF THE CRISES"

Adapted from an address at the 42nd Annual School Dinner, Hart House, December 1st, 1931

BY CANON A. P. SHATFORD

This evening I am going to get away from the atmosphere and activities of your daily University life because you are sufficiently concerned with that already, and so I have chosen for my subject "The Challenge of the Crises". Not merely because we are in a crisis at the moment, but because each life must have its crises. If you have not experienced one already, you probably will very soon, for life is a series of bumps; a succession of calms and crises. Which has more to give to human existence is difficult to say. The calms are very pleasant but they may become deadly in their monotony. The crises have given us great things and they test our powers. If nothing else, the present wide-spread crisis has given us scope and range, and these times are just a repetition of previous ones, just as great and just as seemingly impossible.

There are two common attitudes which people adopt towards the important things in life, and both are weak and wrong. There is the man who travels the highway, treating the crises with a superficial and easy optimism, characteristic of people engaged in unimportant things, seeing the sunlit hills of prosperity always "just around the corner." Then there is the man who exaggerates the situation and is always predicting the worst which is yet to come. And these gloomy prophets are so frequently deeply concerned with non-essential matters which are really of very little importance. A Bishop once told a young man, who was sorely perturbed about something which did not matter in the least, to stick his finger into a pond, pull it out and see what a hole it would leave. As times change, and as we grow older, our opinions of crises change. When I was at college, I used to think that an examination was a real crisis, but now I look back and see how relatively unimportant they are.

Every real crisis in life throws out its challenges to us, and the first of these is the challenge to adventure. When things are uncertain, the only merit is in a moving forward, in a braving of the unknown. A crisis means that there is a weak point in our economic system. It is condemned, and it is from the University that men must come to lead us into happier days.

The second challenge of the crises is a challenge to confidence. In every period of stress in the past it has been the people with confidence who have won through. The engineers, as they dig down into the bowels of the earth, as they throw their mighty bridges across the rivers manifest this spirit; and as we read the pages of history we see that man has always been able to summon up the power to move forward and to overcome his difficulties. To-day we may not have quite as much to live with, but we have still lots to live for. We need only men of courage and spirit.

Thirdly, there is the challenge to sacrifice. By sacrifice, our pioneers built our empire. They did not hesitate to cast off the known, to cross the strange waters and to brave the many dangers. We do not doubt that our resources are still here, and that we are just as well off as we ever were. But we need a spirit of sacrifice in our striving for better things, that our efforts may be made not "with reservations" but with all our energy.

And there is a challenge to leadership. It is in a time of crisis that leaders appear, as history has proved again and again. And to-day we are sadly in need of a leader. In England, in the 14th Century, he came from the University of Oxford; in Bohemia, in the 15th Century, he came from the University of Prague. So in Canada to-day, we look to the Universities for our leader.

Finally, there is the challenge to unity. Everybody must be concerned with and concentrated upon the situation at hand. To-day there is heard the cry for international unity, and men are beginning to realize that there is no such thing as absolute independence. In the building of a nation, in the building of a university, in every engineering project, unity is essential. The engineer, the doctor, the clergyman, the workman must each do his part well and truely and the parts must be all blended together that the best foundations for national enterprise may be established and that the great objective may be attained.

PROSPECTING IN THE FAR NORTH

Summary of an Address before the Engineering Society on December 11, 1931

BY J. E. HAMMELL

On Thursday, December 11th, the Engineering Society was addressed by one of the most famous of our northern adventurers,—Mr. J. E. Hammell, one-time bouncer, prizefighter, explorer, prospector, manager, mine-owner, and now president of the Northern Aerial Prospecting Company.

With his straightforward and interesting style, the speaker outlined very vividly and humourously the many trials that faced miners and prospectors twenty-five years ago. Taking us on a trip up the Mattawa, to Elk Lake, across what is now Kirkland Lake, and into the silver area about Cobalt, he recounted a few of his adventures on the trail. "You've got to be tough in the mining game; you've got to have guts and you've got to have a wallop," was his two-fisted remark. And then again, when a find has been made, the "Wall Street Chiselers" have to be dealt with. "They are a sharp bunch but once an agreement is made they stick to it."

Referring to some of the more recent finds and developments, Mr. Hammell discussed the question of transportation. "People say there is no transportation up there, but it really means nothing. My men flew in all the necessary equipment and supplies for the

winter at Eldorado in three days. The long clear nights are great for flying."

He spoke very enthusiastically of the deposits already known and the possible future developments in that area of northern Canada from Great Slave Lake to the Arctic Ocean. He predicted that the fabulously rich Eldorado silver find, the 70 per cent. copper ores and the promising radium deposits of the district would probably make this the richest mining area in the world in the future.

In conclusion he remarked, "If I were a young engineer, I would throw myself in and out of jobs. For the sake of experience, get into every type of job possible, exploring, prospecting, assaying, but do not take it too seriously. It's all just a great adventure."

RUSSIA AS I SAW IT

Summary of an Address before the Engineering Society on February 16, 1932

BY F. E. ROBSON

With news from Russia censored very rigidly at the border and the variety of "reports" which are always being heard concerning this country, it is not to be wondered at that the meeting of the Engineering Society on Tuesday, February 16th, had a record attendance. Mr. F. E. Robson, who recently completed a 5,000 mile trip through Russia, seeing what he wished to find rather than the bright spots stressed by the guides, told the brute facts in the frankest possible manner. Outlining his trip from start to finish, he endeavoured to give us in the brief time at his disposal, a true picture of conditions in the country.

He emphasized the remarkable enthusiasm and zeal of the people, their faith in the future and their self-denial. One of the most striking features of their new era is the absolute parity between men and women in every type of occupation. Also the procedure and conditions of marriage and divorce have been greatly simplified and have produced a remarkable absence of sex-consciousness. Speaking of the deplorable condition of the labourers, Mr. Robson outlined the tremendous task the government had to face in trying to rule a country spread over one-sixth of the land area of the world, where formerly seventy-three per cent. of the people were illiterate and a hundred and fifty different languages spoken.

Great progress has already been made, but the speaker was not prepared to forecast the final outcome since any slight change in the patriotic fervour of the people or any backsliding on the part of the government might bring disaster. A second Five Year Plan has been laid out and a third is being considered; the five-year periods being chosen since that is about as far ahead as the people can "see in reality."

Mr. Robson stressed the fact that communism is not a menace and that both capitalism and communism must be studied with a view to evolving an improved social order in our own country.

THE UNIVERSITY MAN IN A WORLD-WIDE ORGANIZATION

Adapted from an address before the Engineering Society on January 15, 1932

BY P. M. FOWLIE

A young man leaving University has, broadly speaking, three types of career before him. He may go into a small business and build it up himself, into a business which is nation wide, or into a mighty concern whose ramifications spread to many countries and whose interests are world wide. The Shell Group of Oil Companies is probably as good an example of the third type of organization as can be found, for they are the largest producers of oil in the world, and their activities—developing, refining, shipping and marketing—extend to every corner of the globe.

Life in such a world wide concern is far from monotonous. The young University man joining such a company may not realize the truth of that remark for the first few years, unless he is gifted with imagination. As a Student or Administrative Cadet, he must undergo some years of hard training before he finds things moving at a really inspiring pace. If he enters the manufacturing end, the apprenticeship is hard and often dirty. In the Shell Oil Group, for instance, he may be sent for five years to, say, the Sarawak oil fields in North Borneo. Once a country of head-hunters, it was handed over by the natives to a young British midshipman, named Brooke, who came to aid them in a war and who was acclaimed by them as Rajah of Sarawak. Now Brooke's grandson is the present Rajah and rules as an absolute monarch. It is truely a fascinating country, but our young friend can explore it only during an annual three weeks holiday. During the other forty-nine, he is kept hard at work learning the rudiments of oil-well drilling, of producing from wells which have reached the oil sand, of treating the oil in the adjacent refinery, of shipping the oil to far markets and of the thousand and one other matters which concern the life of an oil field which represents a thriving community built up in a jungle swamp a thousand miles from nowhere. After three or four years of this training work, if he has taken to heart the old Scotch proverb "he that tholes overcomes", he may find his work looked on favourably and so be transferred for further experience to say, the civilized oil fields of California. A couple of years there, a six-month holiday in his home country, and perhaps he is transferred from the gaieties of Hollywood to the Red Sea Coast where he grills in the summer months and sees a shower of rain once in two years. By now, if he is a capable man, he may be in sole charge of some small department and have his first taste of really running something on his own. And on the results of that showing will depend his future in the large organization. These large concerns are eagerly watching for the good men and if the man fails once

he may be tried again, but if he fails twice his future chances are poor.

If the Cadet prefers the marketing side, the training will be just as long and possibly just as varied. Not only must he learn to sell a huge variety of products such as gasoline, kerosene, oils, asphalt, candles, coke but he must learn to adapt his methods to all parts of the globe. He may spend a few years in one country where he sells gasoline in 10,000 gallon lots only to move to another where the chief unit of sale is kerosene in an 8 oz. beer bottle. In America his supplies may come to him through a pipeline, in Arabia they come to him by camel back; he may have to look after an area of two square miles in a thriving city, only to move off to a country where his "area" comprises one town and 500 square miles of practical desert. He may spend three years sweltering in the Congo basin, five years freezing in Northern Manchuria and ten years basking in the West Indies. Or he may never be transferred from his first territory. The variety of possibilities are innumerable and the "luck of the game" deals the hand.

But one thing is certain, those at the very top are eagerly looking for successors and for men able to take part of the load off their shoulders. The life of a Director of one of these concerns is no milk and honey affair and ordinary men cannot stand up to it. To take an example from the Shell Oil Group, a director sitting in his office in far off London must deal and almost always must deal promptly, with problems pouring in by telegram, by mail, and now-a-days by telephone, from all parts of the world. He spends five minutes with the head of one department on the terms of an oil prospecting concession, ten minutes with another on some technical improvement in a refinery process, five minutes with another on the transfer of cash from a country whose exchange threatens to fall to nothing, an hour with some manager home from abroad discussing his policies for the following year, and so on. That sort of life 300 days a year requires a man not only with great mental ability but also of fine physical constitution to stand the strain, and, of equal importance, a man whose character and personality enable him to inspire those under him to do more than their best for the company which they all feel honoured to serve.

It is to the University men that the world will look for leadership in twenty or thirty years. And to those of you who may join world-wide commercial organizations may I point out emphatically, that, as leaders of such concerns, you may share equally with the cabinets of the world in shaping the future of mankind. In training for the company, your own outlook inevitably becomes broader. You realize that your own country is not the only one that matters in this world and you find that her progress is inextricably bound up with the progress of all others. You will find opportunities enough and ample scope to fulfill your destiny.

ANTI-KNOCK FUELS

Taken from an address before the Engineering Society, on February 25, 1932

BY MR. E. SPEED

The story of the development of anti-knock fuels has been closely associated with the development of the gasoline engine in the last two decades. The fact that the use of high-compression ratios increases the efficiency of an internal-combustion engine was well-known in the early stages of engines; but it was not applied commercially until Cadillac endeavoured to produce the first "de-luxe" or "super" automobile embodying the latest knowledge of the time. In service this engine developed a bad knock which was attributed at first to the newly-introduced battery ignition system. The phenomenon was obviously a barrier to further progress, so an investigation was commenced to determine its true cause.

The first step was the construction of an engine with a quartz window through which the process of combustion could be observed. It was noticed that the flame of normal combustion was orange in colour, but that when knock occurred, the flame became a brilliant white. This accounts in part of the overheating which invariably accompanies knocking. At the same time, the Midgeley or visible pressure indicator was developed in which a mirror on the end of a piston road actuated by the pressure in the cylinder deflects a beam of light into a photographic film. The graphs obtained by this means furnished an accurate picture of the pressures reached in the cylinder.

Using these instruments, every available type of fuel was studied and it was definitely established that the knock was due not to the ignition system nor the construction of the engine, but almost entirely to the fuel used. It was found, further, that the knock became more serious at increased compression ratios, and that some fuels knocked more severely than others.

Non-knocking fuels were discovered but were too scarce and expensive for universal use; so the investigators finally turned their attention to a search for some compound which would bestow non-knocking characteristics upon the common fuels. Iodine and aniline were among the first substances found to possess this desired property but they had also several disadvantages. The search was continued systematically, using Langmuir's Periodic Table of Elements as a guide until some thirty-three thousand compounds had been studied. A number of substances were found, having varying degrees of anti-knock. Finally, tetra-ethyl lead was discovered. This proved to be by far the most effective of those investigated, being four hundred and fifty times more powerful than benzol and possessing in addition other desirable qualities.

Following the discovery of tetra-ethyl lead, an intensive campaign of research developed a process for preparing the compound on a commercial scale so cheaply as to make it available to every

motorist. At the same time, a second compound was sought which would combine with the tetra-ethyl lead to prevent the formation of lead deposits in the cylinder. Then a comprehensive series of engine and road tests were carried out to perfect the product and the technique of its use. The result of these investigations is the anti-knock fuel which is generally available to-day.

During these studies, the true nature of "knock" was revealed. In the ideal combustion of gasoline, the fuel burns uniformly and steadily in a very small fraction of a second with a uniform increase of temperature and pressure which delivers a steady flow of power to the piston. When knocking occurs, however, combustion of a portion of the fuel takes place uniformly with a progressive rise of temperature and pressure until the "critical point" for the fuel is reached. Here the combustion of the remainder of the fuel in the cylinder is greatly accelerated, resulting in an explosion or detonation which is heard as knock. Knock is thus the impact of the explosion of a portion of the gases at the finish of the combustion process. It is invariably accompanied by loss of power, vibration, and overheating of the engine. The function of the anti-knock compound added to gasoline is that of controlling the rate of combustion to produce a steady pressure rise and delivery of power.

The fluid now commonly used to treat raw gasoline contains four compounds. The most important of these is tetra-ethyl lead, a colourless liquid approximately twice as heavy as petrol. The second ingredient is ethylene dibromide, also a colourless liquid similar to gasoline, which combines with the lead during combustion to form a vapour which passes out of the cylinder and so prevents the deposition of lead oxide. The third ingredient, ethylene dichloride, assists in this action. The fourth is an organic dye used solely for identification. All four disappear during combustion and pass out with the exhaust.

Since the introduction of anti-knock fuels for general consumption, the development of motor-cars has continued steadily with ever-increasing compression ratios. In the period from 1925 to 1930, engine speeds have increased from 2500 to 3500 r.p.m., the developed horse-power has increased 29 per cent. with an increase of cylinder displacement of only 8.5 per cent., and a corresponding increase of efficiency and economy.

Comparative tests on an engine of 200 cu. in. displacement with varying compression ratios from 4:1 to 6:1 have shown that the developed power increases with improved fuel economy at the higher compression ratios.

Mechanical perfection has reached such a stage, that further progress is checked almost entirely by the limitations of the fuels available. The increased use and improvement of anti-knock fuels suitable for high-compression engines is thus the keynote for future development.

Note—The editors are indebted to Mr. J. N. Fitzgerald for permission to use information cortained in "Harnessing the Power of Gasoline," published by the Ethyl Gasoline Corporation.

SCIENCE AND THE PRESENT SITUATION

Part of an address delivered before the Industrial Chemical Club, December, 1931

BY PROFESSOR M. C. BOSWELL

In casting about for a subject upon which to say a few words to you to-night, the thought persistently recurred to me that many of you will shortly enter the scientific, industrial, or business world, at a very critical time in its history. The revolutionary nature of the age in which we live is everywhere apparent. There is not an activity or interest, not a branch of business, science, art, literature, economics, politics, government, or religion which is not feeling the effects of this universal upheaval.

Now do not grow alarmed. I have no intention of dealing with that sore topic commonly known as "the depression," or of adding any more woe to what is already a very painful situation. We are inundated with articles in the journals and newspapers dealing with such questions as—have commodity prices struck bottom, and, if not, how far down can the bottom possibly be; how many more corners must we turn before we again peer into the face of prosperity; should war reparations and war debts be cancelled; what will happen should Germany, either deliberately or through internal revolution, repudiate her foreign indebtedness; can the disarmament committee of the League of Nations function in February in spite of the Manchurian situation; are tariff walls clever devices for developing the prosperity of nations, or do they constitute a pernicious system which stifles world trade; can wages be maintained with falling commodity prices, and if not what is to become of the thousand and one industries with plant equipment and capitalization for an expanding market instead of a shrinking one; is the Russian experiment a courageous and glorious attempt to ally the great principles of justice and the ideals of humanity with an amazing material development, or is it a fantastic and impracticable dream, full of danger for the human race, impossible of realization, and headed inevitably for disaster; can business be revived by the simple process of ignoring the situation, and "spending money like a drunken sailor?" These and a multitude of other discussions come thronging in daily upon the individual, until his brain becomes a jumble, a kaleidoscope of fleeting impressions with Macdonald, Snowden, Hoover, Mussolini, Laval, Briand, Stalin, Bruening, Hitler, Bernard Shaw, Bertrand Russel, Salem Bland, Rabbi Eisendrath, and Amos and Andy all mixed up in inextricable confusion. The man who can pick his way intelligently through the opposing views of experts on world problems to-day must possess the remarkable qualities of the negro preacher, who stood up in the pulpit before his congregation and introduced his subject by stating "Bredern and sistern, I stand before you this splendiferous morning to explain the unexplainable,

to solve the insoluble and to unscrew the inscrutable." I should apologize for this seeming levity respecting a situation so full, as it is, of suffering and tragedy.

One would think that every possible aspect of the world situation had been thrashed out, every remote corner of the problem had been explored. And yet, except for indirect references to technological unemployment, there have been few discussions of the part which Science has played in this crisis, and the very great influence which Science is almost certain to exert upon world affairs in the future.

I would remind you that after the Napoleonic wars, when men's minds were intent upon the economic and political problems arising out of those conflicts (the Reform Bill, the Repeal of the Corn Laws, and the Irish Question were uppermost in Britain) the foundations were being laid at that very time by Oersted and Ampere, and the experimental work, arising out of these considerations, was being pursued by Faraday, which resulted in the discovery of a means for transforming mechanical energy into electrical energy. This gave rise to the modern electrical industry, with its enormous ramifications, producing a change nothing short of revolutionary in the life of the race. Similarly a few years later the theoretical work of Maxwell, followed by the laboratory experiments of Hertz, laid the foundations for the development of wireless telegraphy and the modern radio industry, which has already exerted a profound influence upon the thought of the world. And yet, to the people of the 19th century, the important problems of life seemed, just as they seem to-day, wholly political and economic. Even to a thoughtful mind such as Gladstone's, the work of Faraday seemed of small consequence—interesting no doubt to the scientific worker, but in importance, nothing to be compared with the Tariff, and the settlement of the Irish Question.

How strikingly similar seems the situation to-day. The world war has left behind problems financial, economic, and political of tremendous magnitude. Almost the entire attention of the world is directed to the solution of the larger or smaller aspects of these problems. And yet to anyone familiar with the research publications of present day Science, realizing the fundamental nature of the work going on in all the Sciences, particularly in Physics, Chemistry, and Plant Physiology, seeing here and there small but significant inklings of possible discoveries of major practical importance, the suspicion grows that once again history will record, that in the 20th century, the great changes affecting the outlook and daily life of the people, arose more from the developments of Science than from the settlement of questions relating to international debts and boundaries, or the decision as to the particular economic system under which man shall live.

But, it may be asked, what about it? This may be all true. But what earthly use is the knowledge that discoveries of this sweeping character have been made in the past and are likely to be made in

the future, to the statesman and economist who are faced with the necessity of dealing with problems awaiting immediate settlement. Surely this knowledge cannot change the nature of the problems to be solved, nor modify the opinions of the men whose duty it is to solve them. True it cannot modify the problems themselves, but common sense would dictate that it should exert a powerful influence towards solving these problems with reference to fundamental principles, and not from motives of expediency or selfish group or National interest. My argument is that Science being fundamental, like justice and truth, and having to do with the forces of Nature, the discoveries of Science are likely to be of a very disturbing character unless the world into which they are ushered is itself functioning according to sane fundamental principles in industry, finance and social relations.

These disturbances of the business world by scientific discovery are likely to occur at more frequent intervals in the future. And it would not be surprising were this aspect of Science to add a very considerable impetus to the growing belief that the institutions and instruments which man devises for his industrial and financial convenience, should also, like Science, be built up from sound fundamental principles. To make my meaning clearer—the business world has chosen in the past to ignore largely the advice and warnings of fundamental thinkers, and has to a considerable extent "run amok" with the idea of business expansion and the exploitation of scientific discovery, and mechanical invention. This has led to a growing domination of man by the machine, of which we hear so much to-day, particularly in the pulpit. This is not the fault of Science, as is so often stated, but rather the result of a faulty economic and social organization which has not yet learned to use the discoveries of Science more intelligently. These discoveries have been flung into the world which has grabbed them with feverish haste, and proceeded to exploit them without regard to the social and economic consequences. Surely this fault should not be laid at the door of Science and of scientific workers. Had more attention been paid during the past one hundred years to the thoughtful men working in the experimental Sciences, as well as in economics, sociology and religion, we probably would have to-day a better balanced civilization and a happier people. As it is, a mess has now to be cleaned up, by the application, mark you, of the very ideas which have either been ignored or received such scant attention in the past.

There are many indications that the world is moving in that direction. For example, Mr. Hoover deals with most of his problems by forming Committees of experts, drawn for the most part from American Universities, for collecting data and forming opinions. This has irritated very much the machine politician, who resents interference with, what he has come to look upon as, his right to settle questions along party lines. Similarly the heads of the English

and other European governments have recently called University experts to their assistance. For instance, Professor Harold Laski of the University of London, whose fine articles in the journals have been so much admired, is one of Mr. Ramsay Macdonald's consultants on Economics. The reports of the German and French governments to the League of Nations at Geneva and to the International Bank at Basel are the work of, and are presented by, professors from French and German Universities. And Mr. King and Mr. Bennett in our own country are beginning to call Canadian University experts into their councils. This is all evidence that the governments have realized at last the futility of leaning on such broken reeds as the old time ward politician, or "the man with an axe to grind," and the necessity for dealing with public questions in a truly scientific way by reference to sound basic principles.

The public will have to rid itself of the idea that the Universities are filled with a lot of theoretical dreamers, whose heads are buried in books, but who have no knowledge of the "hard-boiled world" outside. And I believe there are signs that the popular misconception is gradually disappearing, that University professors are busy weighing moonbeams, or hunting in a dark room for a black cat which isn't there. A chastened and suffering people is modifying many of its old opinions. And the two great institutions of the past, the University and the Church, will very probably soon emerge from their position of retirement, and supply more of the ideas and guidance of which the world is so sadly in need. We seem a long way from a sane adjustment of mechanical invention and scientific discovery to industry and the life of the people. And there are those who view the relationship which exists to-day with grave apprehension, if not alarm.

This is a time for laying hold on the solid substantial elements in life. And so I congratulate you students for having chosen, particularly at this juncture, one of the basic sciences in which to carry on your life work, not only because it will provide you with a means of livelihood, but because it will furnish you with an endless source of interest, enjoyment, and development. As a worker in chemistry you possess, if you have a thorough enough grasp of the subject, an advantage over many other workers. You will be in the happy position of being engaged in a work which has the charm of a hobby. Your work should not be an irksome labour—a task in which you find little or no enjoyment, no mental exhilaration, no stimulus to the imagination. For the whole amazing experimental field of chemistry is open to you, or if you are so situated that you are deprived of the possibility of roaming around this field at will, you can easily follow the roamings of other men, more fortunately placed, by means of the chemical journals and literature.

But, if I may be permitted to advise you, do not occupy yourselves solely with chemistry, or business or industry. Although your life work must engage the major part of your time and energy,

yet you are not primarily chemists or business men but primarily human beings, with minds and imaginations, which should not be restrained within the boundaries of a science or business. You will naturally choose then some outside activities. Your sense of duty with respect to your family, your friends, and the community in which you live, will determine many of these. But of all the interests which directly affect yourself and your family, I know of none which so happily combines keen enjoyment with the expansion of the mind and imagination, as travel in foreign parts. You will return with lasting pictures in your memory of the extraordinary beauty of this grim, gray old world, with a new conception of history, literature, and art and all the products of the mind and imagination of man, and with an increased respect for the qualities of other nations. It is very unfortunate that more people who are well able to travel do not do so, particularly those who exert an influence in the community. It might result in a modification of that self satisfaction and narrow nationalism which results from living too much at home, absorbing the opinions of people in our own communities, estimable as they may be. Travel contributes much to an interest in world politics and to the development of what the Germans call "die Welt Anschauung," or world outlook, which is coming to be recognized as the only basis upon which the present world difficulties can be solved.

But, it may be said, it is all very well to recommend travel with all its broadening influences. Everyone would like to travel, but how is everyone going to secure the necessary time and money to do so? The cost of travelling to and about England and the Continent is not as great as most people suppose, unless one insists upon travelling and living on a plane higher than is essential to comfort. Travel with a view to plain living and high thinking will cost very much less than the reverse, of high living and plain thinking, and the enjoyment and benefits are greatly in favour of the former.

Most of us are obliged to do some careful planning of a financial kind in order to travel. But travel isn't unique in this respect. For what, that amounts to anything, can be secured without planning and sacrifice? Since, then, out of a multiplicity of things to do in this world you men, like all mankind, can only realize a portion, it behooves you to make some conscious decisions, and see that you keep moving in the general direction of your goals. If you do not make these decisions for yourselves, and look after them, rest assured nobody else will do so for you, whereas, having made them, and having commenced to move in the direction of their realization, you will be surprised at the unexpected assistance you will find along the way.

Whatever you do, don't go ambling through life, pulled here and pulled there, with no more decision than a weathercock, and then, having grown old and embittered, cry out against a cruel world for not having taken you by the hand and given your life some direction.

When I commenced to pen these words to you for to-night I had no intention of "preaching at you," or of giving you any advice. It is said to be a sure sign of old age when a layman feels he has reached the stage when he may admonish the youth of the day. My pen has just drifted along, and recorded some thoughts which may have a value for you men, who are about to launch your boats in the very stormy waters of this day and generation.

1932

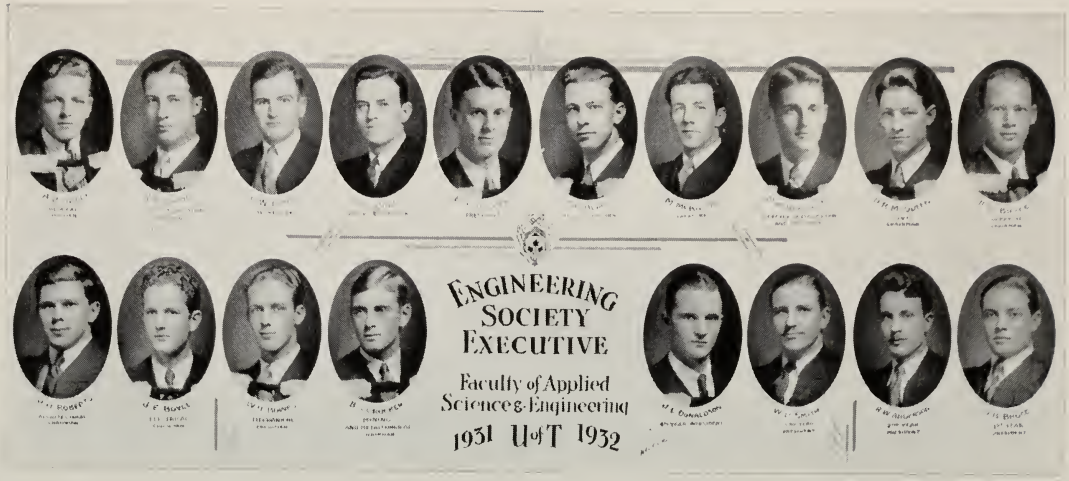
YEAR BOOK

OF THE

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

FACULTY OF APPLIED SCIENCE
AND ENGINEERING

UNIVERSITY OF TORONTO


ENGINEERING
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Elections

The Monday morning after the School At-Home, many ambitious Schoolmen awoke with that morning-after feeling still haunting them to realize that this was "courtesy week", for the elections were at hand. Bluff, blunt fellows were suddenly diplomatic, third year was wreathed in smiles and fourth year suddenly realized it was getting old.

Nominations really began arriving an hour before they were closed. Nobody thought of getting their nominations in early enough to get the advance publicity, and strangely enough, the fourth year were very backward about presenting themselves for permanent positions,—and thereby hangs a tale.

However, by Wednesday all nominations were in and nominees were recognizing people they hadn't known for years. At four o'clock, C22 was jammed by the electioneering meeting. Due to the efficient actions of the morality squad, the meeting attended pretty well to business and stories were dull and decent. Many meetings were held by individual years at which, it is said, better fare was provided. The Hart House elections that day seemed to set the boys a great example and campaigning opened with a bang. The architects took several days off to paint signs and get the money for another year's education. By Thursday, all the School buildings were so covered by signs that they started to overlap and then the fun commenced. Signs appeared in august lecture halls where one might be influenced in the hours of ease. Blotters were so plentiful that ink was at a premium and you had to keep your pen under cover.

Friday dawned like any other day, and lo and behold, the Meds building was not painted. But at the peak of the flagpole someone had hoisted something that certainly was no flag. At noon, a crowd began to gather about the School, indicating that the Faculty's invitation to stay around for the rest of the day was not generally accepted. Suddenly all Scotchmen present were thrilled to hear the skirl of the pipes and then the roll of the drum. Led by a veteran piper, three hundred Schoolmen trooped up to Hart House for lunch. After a dinner in the Great Hall, they reassembled in the East Common Room, where a well-known miner dilated upon the actual episodes leading to the tragic end of Dan McGrew, which wrung the hearts of all. After the stirring episodes of Columbus' voyage had been recalled in proper style, and we had learned again that Pat Heenan's father was fit to eat with the pigs, the moving spirit invaded the crowd once more and they stepped out to the tune of the pipes.

Due to the efficiency of the university police, the artillery display was somewhat dampened, but the parade down to School was otherwise the noisiest and the most colorful in years.

With true informality, violent campaigning was carried on during the polling. Candies, cigarettes, and believe it or not, cigars were given away by ambitious candidates. An organ grinder and

his monkey helped to sway the votes. And in the midst of a very heavy vote, who should arrive but the fire chief to inspect the building as a fire risk. He was finally persuaded to visit the other buildings until voting ceased. If our insurance rates jump, it will be that Fate dealt the cards.

After the responsible work of voting, the crowd dispersed to various down-town theatres for an afternoon of study. The Empire, with its choice burlesque, cured the bulk of the gallant crowd. Meanwhile, in the inner sanctum, the arduous task of deciding what was meant by the mark on the ballots was under way.

Due to the Marfleet lectures in Convocation Hall, our usual brawl in the second year drafting room was forestalled by the Superintendent. After much work and more worry, the athletic wing of Hart House was kept open for School, and there at 7.30, the gang arrived with high spirits. Though chariots were taboo (no horses allowed in the house), other forms of sport, such as bull-fighting, tug-of-war, wrestling, blindfold boxing and swimming occupied the passing hour. For those who didn't take to the sports, movies were provided of ancient vintage. At 9.30, we assembled in the Great Hall for cider and sandwiches and saw the trends and results of the election illustrated in true engineering fashion.

With the elections over, we start once again into the long grind for exams.

R. B. Bryce,
Returning Officer

Election Results

Friday, March 4, 1932

ENGINEERING SOCIETY

President ..... J. S. Ball
First Vice-President ..... M. McKillop
Second Vice-President ..... C. W. Tyson
Treasurer ..... L. C. Benson
Secretary ..... D. B. Bruce

ATHLETIC ASSOCIATION

President ..... J. R. Fitzpatrick
Vice-President ..... E. H. Sinclair
Secretary-Treasurer ..... H. K. C. McNichol
3T3 Representative ..... L. J. Lichty
3T4 Representative ..... E. R. Eaton
3T5 Representative ..... G. H. Scott

CLUB CHAIRMEN

Architectural Club ..... G. R. Whale
Chemical Club ..... W. J. Beynon
Civil Club ..... J. J. A. Howe
Debating Club ..... H. C. Herz
Electrical Club ..... M. A. McKay
Mechanical Club ..... W. R. Coulter
Mining and Metallurgical Club ..... F. V. C. Hewett

PERMANENT EXECUTIVE 3T2

President ..... E. S. Jewett
Vice-Presidents ..... J. L. Donaldson
M. M. Hendrick
Secretary-Treasurer ..... E. A. Peaker
Councillors ..... E. A. Black
A. B. Green
D. R. McQueen
J. E. Thom
R. B. Bryce

EXECUTIVE 3T3

President ..... F. R. West
Vice-President ..... C. J. Bridgland
Secretary-Treasurer ..... M. J. Werry

EXECUTIVE 3T4

President ..... W. M. Kellett
Vice-President ..... H. L. Shepherd
Secretary-Treasurer ..... H. J. Wilkinson

EXECUTIVE 3T5

President ..... D. G. Ritchie
Vice-President ..... N. M. Kelly
Secretary-Treasurer ..... W. R. Alexander

BRONZE "S"

R. A. Adams


P. J. HOWE
Vice-Chairman
D. R. McQUEEN
Chairman
Prof. R. YOUNG
Hon. Chairman
Prof. T. R. LOUDEN
Hon. Vice-Chairman
Prof. W. H. PEARCE
Hon. Vice-Chairman
J. M. JORDAN
3rd Year Rep.
W. M. BURGLYNE
2nd Year Rep.
W. A. H. LOVE
1st Year Rep.
CIVIL CLUB
EXECUTIVE
Faculty of Applied
Science and Engineering
1931 U of T 1932

The Civil Club

It has been the custom for many years now that the students in engineering take part in an annual visit to some out-of-town point of interest. This year, the members of the Civil Club journeyed over to Niagara Falls on the 22nd day of October. The new filtration plant for the city waterworks system on the Canadian side was the main point of interest. Due to a flat tire (genuine), those in the bus were somewhat late in arriving, but plenty of time had been allowed for such unavoidable delays. The filtration plant proved to be very interesting, being modern and up-to-date in many ways. Then immediately after lunch we were conducted down to the abutments of the Canadian National Railway arch bridge by means of a very winding and steep stairway. This proved to be very interesting, due to the manner in which Professor C. R. Young described the various details of the bridge. On going over to the American side, we saw a model of Niagara Falls at the old plant of the Niagara Power Company. The effects obtained by removing certain sections of the river bed, and placing submerged weirs in others, showed how more water could be taken from the river without destroying the scenic beauty. This part of the day was brought to a close by a visit to the power plant of the Niagara Power Company.

In the evening the majority of the party went to a show, to bring a very interesting day to a close. On the way home we examined the various souvenirs secured during the visit, chief among them being an up-to-date "petermeter" secured by John Borbey.

On the 8th of December, the fall smoker was held in the east common room of Hart House. Professor Rogers gave a very interesting address on criminology, a field in which he is an expert. He told us very vividly of some of his experiences as a crown witness. After the address we journeyed up to the Grads' dining room and enjoyed a light lunch.

And now the term is drawing to a close. With a haste that might be termed feverish, we pore over notes that we haven't seen since last fall, in the hope that it is as yet not too late. But it won't be long now until this year's struggle will be over, and then comes . . . well, whatever it is we don't know, maybe it will be digging ditches . . . who knows! However, we are not downhearted but look forward to a bright and happy future.

Congratulations are offered to "Kelly" Howe on his election to the chairmanship of the club, and we wish him every success in the coming year.

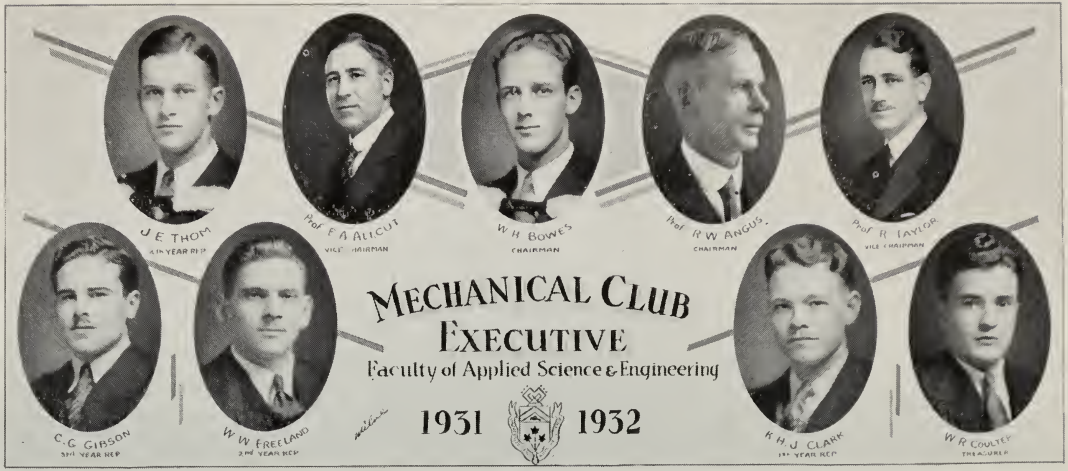
D. R. McQueen,
Chairman

FOURTH YEAR CIVILS

Back Row: J. W. Whytock, E. Miall, J. L. Donaldson, H. L. Hayhoe, A. D. Mann, W. E. Brown.
Second Row: J. G. Powell, T. W. Wilson, E. A. Black, D. L. Tait, R. W. Emery, D. R. McQueen, F. H. Tucker, J. A. Fisher.

FOURTH YEAR MECHANICALS

Back Row: B. Cowan, W. B. Kitchen, J. S. Elliott, W. D. McCallum, A. C. Macnab, C. M. Barrett, E. B. Hymmen, B. D. Park, S. W. Yuill, L. J. Price, W. J. H. Bates.
Middle Row: H. T. Wright, W. J. Wood, W. E. Micklethwaite, W. E. Algie, M. M. Hendrick, F. G. Ewens, C. G. Southmayd, R. A. Adams, J. V. Reid, W. M. R. Griffin, A. Robertson.
Front Row: J. E. Thom, B. H. Russell, Prof. C. G. Heard, Prof. R. Taylor, Prof. R. W. Angus, Prof. E. A. Allcut, Prof. W. G. McIntosh, W. H. Bowes, E. S. Jewett.
Absent: E. W. Benjamin.


J. E. THOM
4TH YEAR REP.
Prof. F. A. ALCUT
VICE CHAIRMAN
W. H. BOWES
CHAIRMAN
Prof. R. W. ANGUS
CHAIRMAN
Prof. R. TAYLOR
VICE CHAIRMAN
C. G. GIBSON
3RD YEAR REP.
W. W. FREELAND
2ND YEAR REP.
MECHANICAL CLUB
EXECUTIVE
Faculty of Applied Science & Engineering
1931 1932
K. H. J. CLARK
1ST YEAR REP.
W. R. COULTER
TREASURER

The Mechanical Club

The Mechanical Club is twenty-five years old this year. Long may she live! In 1907, the Mechanical and Electrical Club was inaugurated as the official student organization for students in these two departments. Two years ago, the Mechanical and Electrical Club was divided into its two separate departments owing to the fact that about half the enrolment at the School fell within this Club. We may well feel proud that despite this split the Mechanical is still the largest club.

Our activities this year began with the trip to Niagara Falls, Buffalo and Queenston. This trip is always very instructive, especially to freshmen, and it may be safely said the excursion was entirely satisfactory. Unfortunately, by ruling of the Faculty, there will be no general trip next year, but the various clubs will be allowed to organize their units to visit plants of interest individually.

Two smokers were held, one before and one after Christmas, our speakers being Professor Angus, and Mr. W. H. D. Clark of the Combustion Engineering Corporation, Montreal. As a suitable ending, the Mechanical Club "At-Home" was held at the Silver Slipper. It was well attended and highly successful.

We hope that the next executive will enjoy every success in its administration, and we would like to wish the members of the present club all success in their examinations.

W. H. Bowes,
Chairman


BALMER NEILLY
E.O. WITHROW
MINING
and
METALLURGICAL
CLUB EXECUTIVE
Faculty of Applied
1931 Science 1932
and
Engineering

The Mining and Metallurgical Club

As we look back over the Club's activities for this year, the seventeenth year of its existence, we find that the programme has been varied and interesting. The past season has been one of the most successful in the history of the Club. This has been due largely to the interest and support shown both by the undergraduate members of the Club and the Toronto mining men, and to the excellent quality of our after-dinner speeches.

We again continued the policy of having a practising mining engineer as our honorary chairman, and were very fortunate in having one of the Club's oldest and strongest supporters, Mr. Balmer Neilly, in that office. Much of the Club's success has been due to his able and energetic support.

The activities of the Club have been continued as in previous years. We opened the session with an initiation smoker held in Hart House early in October. There is something about this function which warms the hearts of the incoming freshmen. After the entertainment, we had a light lunch in the Great Hall.

The annual trip was made to Niagara Falls, Buffalo and Lackawanna. We were fortunate this fall in having ideal weather. Our first stop was made at the Niagara Falls Power Company, where we were shown the model of the Falls, and given a demonstration of the effect of the proposed improvements. Then we went on to Buffalo and had dinner at the Hotel Statler. In the afternoon we journeyed to Lackawanna and went through part of the Bethlehem Steel Works. The evening was spent in Buffalo.

Our first dinner meeting was held in November at Hunt's. Mr. Balmer Neilly spoke to us on the Mining Tax Act of Ontario. Both the address and the discussion that followed proved very interesting. A feature of this meeting was the fact that all our past honorary chairmen were present at the head table.

Our January meeting was held at the Diet Kitchen. Mr. Hibbert of Noranda was our guest speaker. He spoke on "Mining in Russia," and told us some very interesting stories about the Russian miners.

In February we were extended the privilege of holding our meeting at the Engineers' Club. This meeting was conducted in a formal manner, and toasts were proposed to the King and to the members of the Engineers' Club. The latter was replied to by Mr. G. C. Bateman, past president of the Engineers' Club. Mr. E. G. Williams ably introduced Dr. A. P. Coleman, the speaker of the evening. Dr. Coleman gave a very fine address on the mining camps of South Africa. His talk was illustrated by beautifully hand-painted slides. This meeting was enjoyed by all and was well attended. Several of our more recent grads returned for it.

The social event of the year was the delightful At-Home given by the Association of Women of the Mining Industry. This was

FOURTH YEAR MINERS AND METALLURGISTS

Back Row: Prof. J. T. King, B. S. Crocker, Mr. S. E. Wolfe, D. Grant, T. W. Johnston, W. E. Anderson, B. K. Seli, Mr. McClelland, W. A. Wall, L. K. Lyttle, R. B. Bryce.
Middle Row: L. K. Walkom, E. O. Withrow, T. G. Howe, E. C. Rudd, P. L. Clark, M. E. Hertel, V. M. Humphries.
Front Row: F. C. Butler, E. J. How, E. O. Tigert, G. H. Barnes, R. J. Beggs, T. A. Kirk, G. A. Campbell, R. E. Irwin, W. A. Ross, Prof. H. E. T. Haultain.
Absent: C. S. Boland.

held at University of Toronto Schools near the end of November. The new mill was officially opened this fall by the Hon. Charles McCrea with Sir Robert Falconer presiding over the ceremony. Tea was served in the building afterwards.

The executive of the Club would like to take this opportunity of expressing their appreciation to the many people to whom they feel they are indebted. We would like to thank the members of the Faculty for their support, and also the many Toronto mining men who have turned out to support our meetings and speak to us. Our honorary chairman, Mr. Balmer Neilly, has been of great assistance throughout the year. And finally, may we thank the members of the Club for their cooperation and support during the past year. We have broken all attendance records at our dinner meetings this year.

We feel that we can safely hand over the control of the Club to Frank Hewitt, next year's chairman, and his executive, and wish them every success.

B. S. Crocker,
Chairman


Miss D. F. LUMLEY
SEC. TREASURER
H. H. ROBERTS
CHAIRMAN
J. H. CRAIG
HON. CHAIRMAN
G. R. WHALE
R. D. SINCLAIR
4TH YEAR REP.
W. E. YOUNG
3RD YEAR REP.
ARCHITECTURAL
CLUB
EXECUTIVE
Faculty of Applied
Science and Engineering
1931 U of T 1932
H. K. BLACK
2ND YEAR REP.
J. M. SAUNDERS

The Architectural Club

This year of grace has not been one of depression for the Architectural Club. It has been one of satisfying events.

To begin with, the annual trip to Gull Lake was even more successful than usual; the work in water-colour this year showing a decided upward trend in standard. Besides which, several of the members came closer to nature than ever before. Yes! indeed, there was more than one who sat accidentally on the bottom of Rackety Creek, when the creek-bed was full of water, and not least in interest was the lady known as "Lou".

The dinner this year was a decided success. It was held at the Royal York Hotel. The old Architectural custom of freshman initiations on this night was repeated for one more year. The system of individual effort on their part was discarded. Instead, they put on skits, etc., in groups. The result was a riot of fun and a credit to the Frosh. Our Honorary, or, as the menu read, Honourable Chairman, Mr. Craig, gave an excellent talk on the recent legislation concerning architects.

Throughout the year, interesting talks and pictures were given and shown on diversified subjects by men qualified to do so.

The annual dance was held at the Embassy Club in February. From the standpoint of music and floor, it was a real success, but the arrangement left something to be desired, in keeping the party together as a whole. This experience may well be considered by the incoming executive.

In conclusion, the writer can only hope that the support given the new chairman by the executive will be as full as that enjoyed this year.

H. H. Roberts,
Chairman

FOURTH YEAR ARCHITECTS

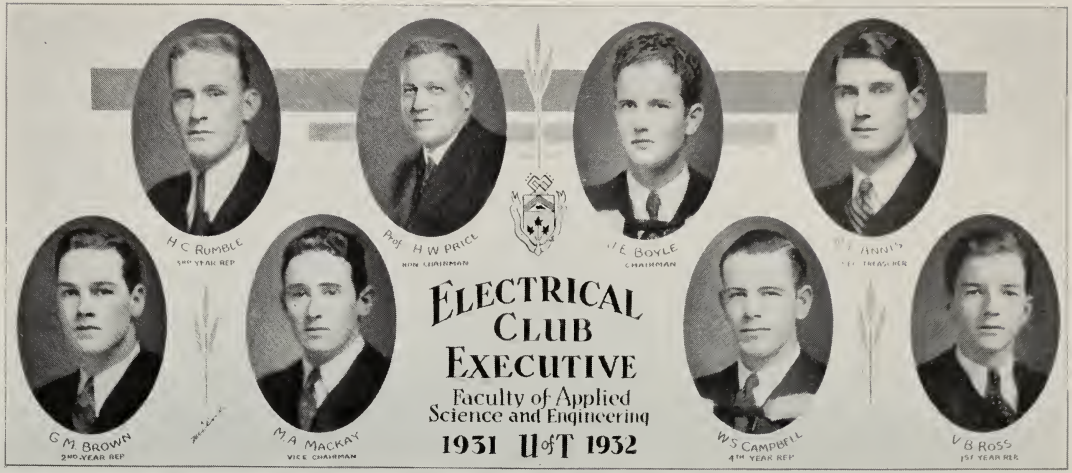
Back Row: Mr. M. Waters, Prof. H. H. Madill, Mr. W. E. Carswell, J. J Rempel, R. D. Sinclair.
Front Row: M. M. Pulver, R. M. Wilkinson, G. R. Whale, H. H. Roberts, Miss K. W. Jefferys, W. G. Quantz.

FOURTH YEAR ELECTRICALS

Back Row: J. L. Falconer, W. O. McCaughrin, J. Lindsay, J. A. Taylor, D. C. Allan, J. K. Bradford, W. J. Jackson, C. W. Tocher, A. Levitan, R. W. Buttery, W. L. Peddie, J. W. Lochead, W. S. Campbell.

Middle Row: Mr. R. J. Brown, Prof. H. W. Price, H. M. Brouwers, B. Heimburger, B. M. Graham, W. B. Proudfoot, J. G. Porter, J. R. Rutherford, J. F. Moore, E. J. McDougall, K. C. Clark, Mr. B. de F. Bayly, Prof. A. R. Zimmer, A. K. Bayley, M. C. Patterson.

Seated: Mr. M. Ward, C. H. Abray, A. S. W. Frizzell, J. J. Kelly, J. R. Pepall, J. E. Boyle, Assist. Prof. V. G. Smith, Prof. T. R. Rosebrugh, A. A. Jansen, G. G. Milne, W. B. Whalley.


H C RUMBLE
3RD YEAR REP
Prof H W PRICE
HON CHAIRMAN
J E BOYLE
CHAIRMAN
G M BROWN
2ND YEAR REP
M A MACKAY
VICE CHAIRMAN
ELECTRICAL
CLUB
EXECUTIVE
Faculty of Applied
Science and Engineering
1931 U of T 1932
W S CAMPBELL
4TH YEAR REP
V B ROSS
1ST YEAR REP

The Electrical Club

The close of the session is now almost upon us, and brings labs and lectures to a finish once more. For some of us it is the "break-up," while for others it means five months away and then back for another round.

The annual trips took place late in October and again proved to be the success of former years. The first year managed to get as far as Hamilton, where they made trips through the plants of the Canadian Westinghouse Company. Buffalo laid claim to the second year to show them how interesting a steel mill is when it won't function, and how they can mix telephone exchanges and broadcasting stations into the day's realm of education. In Peterborough the third year spent the day, from an educational viewpoint, viewing the works of the Canadian General Electric Company. No shows for the evening but these boys know how to substitute! The interest of the fourth year was first attracted at Queenston, where the origin of the kilowatt was discovered. To help neutralize this unexpected enthusiasm, we were next informed at the American Falls how "bigger and better" kilowatts were mixed up and thrown into circulation by the "biggest and best generators in the world." At the Canadian Falls we saw where water was taken in for the Ontario Power Company and what it did when it got there. None of these trips are complete without passing judgment on Buffalo's latest offer in recreation, so the nose of Mr. Gray Coach Line was turned towards our next conquest. The hilarious nature of the gang only had to be dampened at the Peace bridge, and it was a good show!

The fall term meeting was held as a smoker in Hart House. Mr. A. G. Turnbull of the Canadian General Electric described some of the newest developments in industrial control systems, and how the photo-electric cell could act to turn nearly anything on or off. The motion pictures which were shown depicted very clearly the complications and difficulties encountered in remote control installations.

In January, Professor H. W. Price, honorary chairman of the club, gave a most interesting talk on some of the more recent inventions and engineering developments. The good turnout at each of these meetings indicates that they should comprise a more prominent part in the activities, even if they make Charlie Tocher sick. A more social touch was added when a dance was held at the Embassy in February, and the success of this new venture suggests that it should be a continued feature in the year's programme.

We congratulate Murray MacKay on being elected chairman for next year. He knows the job, having served this year as vice-chairman, and with wholehearted support is certain to have a very successful year.

J. E. Boyle,
Chairman


G.R. DAVIDSON
A.B.
DR. H.C. GUNNELL
R.E. BEYNON
J.J. BEYNON
F.W. WESTMAN
E. LEE
L.D. DOUGAN
R.P. BAILEY
F.R. GORRIE
INDUSTRIAL
CHEMICAL CLUB
EXECUTIVE
Faculty of Applied Science
and Engineering
1931 U of T 1932

The Industrial Chemical Club

"A poor life this if, full of care
We have no time to stand and stare."

W. H. Davies, "Leisure."

I think that that quotation is peculiarly applicable to the life of the undergraduate chemical engineer at the University of Toronto. Perhaps if it were not for the Industrial Chemical Club his would not be a "poor life." I mean to say that it has invariably been the case, when the subject of an impending function of the club is broached, that the work-belaboured, nerve-racked object of professorial effort glibly replies that he hasn't time. After he has been individually and conclusively convinced that it is in his better interests, and he consents to participate, the conviction descends upon us that we have taken the last lingering hope of a moment in which to stand and stare. Nevertheless, recalcitrant as the members of the session 1931-32 might have been upon the first intimation of a proposed function, they, be it only at the last second, heartily supported every gathering which it was our pleasure to organize. Witness the inter-year trip with a boisterous band of one hundred and fifteen souls travelling to a rendezvous one hundred and twenty miles away for some "practical knowledge."

A word on this trip in passing. The weather was perfect, as if made to order, on October 22, 1931. Buffalo was the destination, and despite the disruption caused at the border by a misguided champion of liberty in "olive drab," the party, less one, arrived at the American metropolis. Thanks to the kindness of the management of the Hotel Statler, the group was favoured with a home for the day in the form of a magnificant suite. Luncheon was had under the same roof. Institutions visited were the Huntley Street plant of the Niagara-Hudson Power Company, the Mentholatum Company, the Washburn-Crosby Milling Company, the newest exchange of the American Telephone Company, and the "Gayety".

After a couple of weeks, in which the student mind again became focussed on the more immediate surroundings, a smoker was held at which the members, 110 strong, were privileged to see some really artistic work in the form of moving pictures of Germany, taken and shown by Mr. H. P. Mills of the Bakelite Company.

December arrived hot foot on November (as frequently happens) and with it the annual dinner (called the annual dinner because two are held each year). Little need be said of the dinner here save that 108 shining faces were in evidence at the Carls-Rite on the evening of December 16th. Two excellent addresses were given, Mr. E. T. Sterne speaking on "Advice to Young Engineers," in which he gave us the retrospective viewpoint of engineering; and Dr. Boswell delivered that very fine paper which appears elsewhere in this publication.

In view of his intricate connection with that important division of chemical industry—Bakelite—and also by reason of his friendly

FOURTH YEAR CHEMICALS

Back Row (standing): C. D. Martin, E. A. Peaker, W. H. Bowman, H. L. Hinchcliffe, M. A. Luck, F. G. Peters, C. S. McIlroy, B. L. Brown, C. P. Olstad, J. O. Killer, A. M. Bell, H. E. Ney, G. W. Gilbert, V. A. Wood (deceased), G. H. C. Smith, H. A. Smith.

Middle Row: R. W. Jenner, G. A. Lee, S. G. Webb, T. R. Nicholson, E. S. Rudder, G. A. Scythes, F. W. Westaway, S. H. Jackson, R. E. Nelson, A. B. Green.

Front Row: Dr. R. R. McLaughlin, Dr. M. C. Boswell, Prof. J. W. Bain, Prof. E. G. R. Ardagh, Prof. L. J. Rogers, Prof. E. A. Smith.

interest in the club, Mr. Mills was again asked to address the club. February 10, accordingly, saw Mr. Mills, a multitude of display products, a moving picture machine, and eighty-five interested members assembled at Hart House for a second smoker. Thanks to "Workie," a somewhat halting sing-song was put on its feet to open the meeting. Interest in the subject necessitated a hasty lunch in the Great Hall in order to avoid being locked in the building.

At the time of going to press, arrangements have been completed for the second and final dinner of the year to be held about March 15. Dr. Burton of the Department of Physics has promised a most interesting talk which is sure to draw a crowd well up to previous standards.

The seasons 1930-31-32 have established a precedent in Chemical Club history. For 1932-33, "with Beynon in the chair," small hope for "time to stand and stare."

A. B. Green,
Chairman

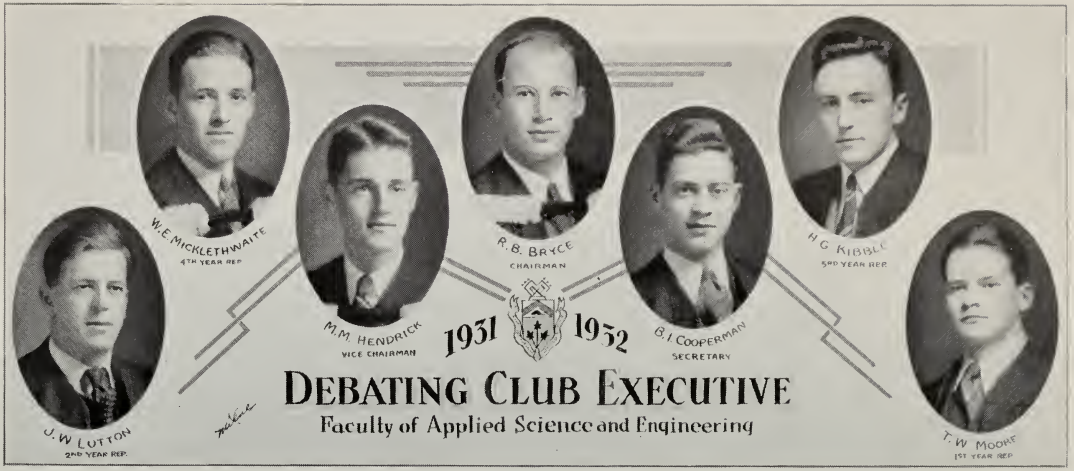
Debating Club

It would seem that whenever this club comes into print, it tries to justify its existence. Fully realizing the implications of this action, we are going to bow to custom and say a few words on the objects of its being.

Engineers are notoriously bad speakers, particularly for university graduates. This is probably why so few engineers take a prominent part in public life. Surely, now if ever, the world needs the engineering approach to its problems in the economic and political field. It has, for years, been the avowed purpose of this club to assist the embryo engineer in acquiring the art of speaking to a gathering. It attempts to do this by affording him practice, and by having him see the successes or mistakes of his fellows, usually in the same position as himself. The art of speaking cannot be developed except in such a way as this.

While we agree that this utilitarian purpose of the club is its principal "raison d'être," we insist that it has other objectives nearly as important. Indeed, it would need to, for a debate among men whose only purpose was practice would be a sorry affair. Imagine a rugby game where the players thought only of getting exercise! If we did not have more immediate objectives, we would defeat our one purpose, insofar as we would be too self-conscious to speak fluently.

One of our real objects is to provide enjoyment for those who love an argument. We have found that there are many such in our faculty if we can dig them out from under the mountains of lab reports. Those acting from this motive take keener interest in debates and usually contribute more than the mere time-server with his long-term objective. Informal debates have been found to stimulate this spirit more than anything else.


W. E. MICKLETHWAITE
4TH YEAR REP
R. B. BRYCE
CHAIRMAN
H. G. KIBBLE
5TH YEAR REP
M. M. HENDRICK
VICE CHAIRMAN
1931
1932
B. I. COOPERMAN
SECRETARY
J. W. LUTTON
2ND YEAR REP.
T. W. MOORE
1ST YEAR REP.
DEBATING CLUB EXECUTIVE
Faculty of Applied Science and Engineering

Another objective which the executive has tried to foster this year, and for which the future holds promise, is that the club should prove a forum for the discussion of matters that concern engineering and education for it, and where the undergraduates of this faculty can air their views on current questions. There is far too little questioning of institutions and policies in this faculty, and this club should provide the hotbed in which a useful radicalism can develop. Surely student opinion has more to express than can be put into red paint and "Toike Oikes."

In the writer's opinion, that which stands most in the way of the main objective of this club, in the way of broad education for engineering, is the ridiculously overcrowded curriculum in this faculty. Until the students are entrusted a little more with their own education and encouraged to think for themselves,—and given time to do it—this school will not truly educate, nor accomplish what Dr. Fyfe has so aptly termed "men engineering."

The club debates of last fall were of an informal nature and were better attended than in the past. The subjects which proved of general interest were "Closing the Engineering Profession" and "The Value of Examinations, if Any."

Our annual dinner took place in January. Mr. James Cowan, barrister, addressed us and amusingly illustrated many of the pitfalls into which a speaker may be lured.

The Third Year, represented by Hewitt and Kibble, have won the Sedgeworth trophy for interyear debating. The final debate between this and the First Year team, on "Government Control of Radio," was hotly contested and the judges found it hard to decide the winner.

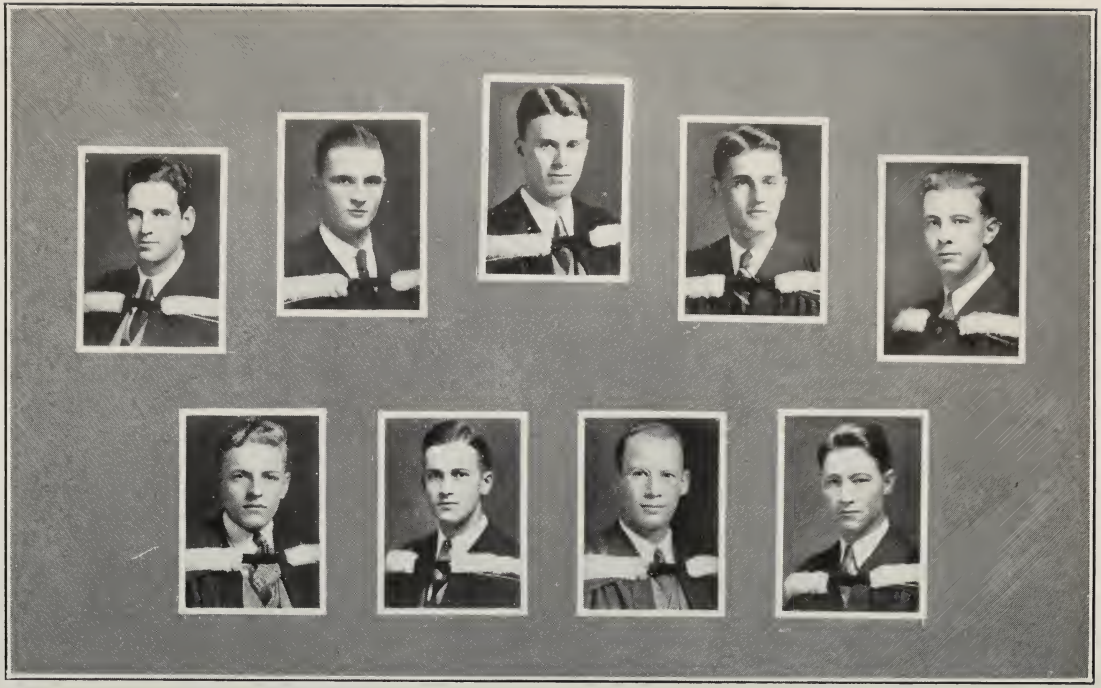
The oratorical contest is yet to be held, and those who can spare the time from the hectic pursuit of knowledge will vie for the honours of Demosthenes (not to mention the coin of the realm).

We wish to thank those members of the club who have prepared debates, those members of the staff who have acted as judges, and others who have contributed to the success of our meetings.

There is a possibility of interfaculty debating next year, in which we hope School will be well represented.

We wish next year's executive every success and trust that under Herman Herz they will prosper and bear fruit.

R. B. Bryce,
Chairman



PERMANENT EXECUTIVE OF 3T2

Top Row: E. A. Peaker. J. L. Donaldson, E. S. Jewett, M. M. Hendrick, E. A. Black.
Bottom Row: A. B. Green, J. E. Thom, R. B. Bryce, D. R. McQueen.

Message of the Permanent Executive 3T2

It has been said that "the University is one of the pillars on which Western civilization rests." If this is so, surely the Faculty of Applied Science of this University is the very foundation of that pillar, and the class of 3T2 the mortar which has held that foundation together for four long but happy years. Yes, maybe this is rather far-fetched, but at any rate, we think the class of 3T2 one of the finest that has ever graced these noble halls of learning, and in looking over the records of the year as a whole, possibly the above metaphor will be excused.

To get down to business however, this executive of able-bodied, weak-minded men has been elected by you to look after your interests, and we intend to do just that, even if we become weaker in body as well. Don't imagine for a moment that you can escape us, we'll track you down wherever you go, so you might as well let us have your addresses and the news about yourselves first as last. Be sure to let us know as soon as you are married, we must have some method of estimating the increase in the size of our class.

This year the Engineering Alumni have made us a very special offer. In order to encourage the present graduating class to maintain its close contact with the University and with the Alumni, they are willing to give us membership at a greatly reduced rate. The membership also includes a subscription to the MONTHLY. This is a generous and friendly move on the part of the Engineering Alumni; and it is to the advantage of everyone to make use of it.

This executive would like to take the opportunity at this time of wishing each and every member of the class of 3T2 the success he so richly deserves and looks forward to many happy re-unions and backward with more than one sigh of regret to joyous times spent together.

E. S. JEWETT,
President.
466 Gladstone Ave.,
Toronto.

EDWIN A. PEAKER,
Secretary-Treasurer.
135 Jameson Ave.,
Toronto.


W. S. CAMPBELL
ELECTRICAL REP.
G. A. CAMPBELL
SEC.-TREASURER
J. L. DOWNIDSON
PRESIDENT
DEAN MITCHELL
HON. PRESIDENT
F. S. LEE
VICE PRESIDENT
J. E. THOM
MECHANICAL REP.
FOURTH YEAR
EXECUTIVE
Faculty of Applied
Science & Engineering
1931 U of T 1932
F. W. WESTAWAY
CHEMICAL REP.
E. O. WITHROW
MINING & METALLURGICAL REP.
R. O. SINCLAIR
ARCHITECTURAL REP.
H. M. SMITH
ATHLETIC ASSOCIATION REP.

3T2

The journey's end draws near and the members of one of the more remarkable classes of old S.P.S. are looking about for implements—not brushes and shovels either—with which to pitch in and take a round out of Old Man Depression. In the light of past accomplishments this should not be impossible for, in work and sport, we have done our part in upholding the names of Faculty and University for the last four years.

Does every man remember how long ago it seems when we, too, were frosh—uncertain as to offices and buildings, a little timorous when alone, but soon drawn together under the leadership of Warren Bowes into a compact and organized group, resenting and resisting the domineering attitude of the sophs? Quite a battle—that first brush in the old Red School House, and our initiations—not so bad either. Then came the Soph-Frosh banquet and the good clean fun that went along with it; later, a slaughter of the innocents in April, and the return in the autumn, wiser men.

Spence Jewett was our leader through the horse (and hose) play of the second year, when we raised initiation ceremonies to the high plane they now hold, and buried, with pleasant memories, the last banquet that the neophytes were permitted to tender us. Great parties that year, and a bang-up election as well.

By third year, those remaining had become tempered with discretion and Ernie Black guided a quiet and almost orderly group of men. To be sure, the Civils and Miners, fresh from Gull Lake, still gathered together of an evening but only, as far as anyone knows, to hold discussions about the finer things of life. Two smart dances on our own and several functions of other organizations almost adopted by our members filled the social programme.

And now to the fourth and final session, only a hundred and thirty-nine strong and entirely different men from the raw material of 1928. We have much to look back on in those days of college life and little to regret. Soon we scatter, with many good times behind us, but these memories must not die. Let us spread the tidings that the spirit of 3T2 will carry on after the graduation of its members and that the record of their accomplishments will be a target for others to use. Finally, don't forget this,—"To meet at the first reunion."

J. Logie Donaldson,
President

MATTHEW W. HAMILTON

Matthew W. Hamilton, a member of the class of 3T2, passed away suddenly from a heart attack on May 6, 1931. He collapsed after flying to the Matachewan gold field where he was to have been employed for the summer months. Word of his death was a shock to his friends, as he had left the city only a few days before in good health. The sad news came several hours after the papers announced that he had been successful in passing the third year examinations.

Matt was born in Toronto in 1909 and attended the local schools, obtaining his matriculation at Riverdale Collegiate Institute. He took an active part at Broadview Y.M.C.A., being interested in the Boys' Fall Fair, as well as playing basketball for the Broadview team. He attended St. John's Presbyterian Church.

In 1928, he entered the course in mining engineering at the University. During the summer following his first year, he was a member of a field party prospecting in the Patricia district, and the next year he spent at the Kirkland Lake gold camp.

In Matt's death, School lost a bright and promising undergraduate.

V. ARTHUR WOOD

While the carillon of Hart House chimed, School sadly paid its last respects to Art. Wood of 3T2, victim of that tragic accident in the Chemical Lab. The explosion of his autoclave, occurring without warning during an experiment, inflicted mortal injuries against which he struggled valiantly for two days. The best efforts of medical science, including blood transfusions from several of his classmates, were unavailing, and he passed away on Wednesday, February 17.

Art. spent his boyhood in Simcoe. Following the death of his mother, he went to Shelbourne, where he attended high school. In his work at University he was very thorough, obtaining honours in his second and third years. He was of a friendly disposition and was well liked by those with whom he came in contact. At Trinity United Church he was an active executive of the Ryerson Young

Men's Bible Class. In the laboratory, as well, he exhibited his qualities of leadership and was always ready with helpful suggestions for his classmates. He was very interested in research work, and it was while attempting to find a new method for the oxidation of benzene directly to phenol, that the fatal accident occurred.

The undergraduates and the Faculty deeply mourn the loss of a real friend and brilliant student.

3T3

Although 3T3 suffered from an acute attack of indigestion—due to the determined effort of the powers that be, to make us or break us, by cramming more engineering into us in one short year than is good for either us or the unsuspecting public upon whom we hope to try our skill eventually, and in spite of the appalling prevalence of this so-called depression in our midst, we nevertheless were able on two memorable occasions to assemble in party array.

On both occasions the boys were out in force, determined to trample under foot, to the tune of fox-trots and waltzes, the tangle of heat units and hydraulic grade lines. Enchantingly lighted as the halls were, due to the untiring efforts of Addison and Sykes, one could never have told, from the expressions on the face of each member, as he held some lucky co-ed in his arms and whispered soft nothings, perfected by three years of university training, that he had a lab to write when the dance was over. What do we care for sleep—anyway, you never could keep an engineer at home.

A member of the staff was also persuaded to cast aside the guise of teacher and renew acquaintance with us on a more equal footing. He joined in the fun with much gusto and aplomb. Accordingly, for the many who were fortunate enough to attend—all requirements for a very successful party were satisfied on both occasions—and their cup of pleasure filled for at least two nights during a strenuous and busy year.

W. D. Smith,
President.

3T4

Each succeeding year seems to be the best yet, and this one is no exception. That is merely a matter of opinion, and opinions must be substantiated, but without undue conceit we can truthfully say that 3T4 S.P.S. holds a unique position in university life. This can be attributed to no individual effort but to the wonderful spirit of co-operation of the entire year. To them goes the credit. We, the executive, are merely figureheads to carry out the wishes of the masses, and we sincerely hope our efforts have met with the approval of all.

Early in the term it was our privilege and pleasure to welcome a large class of freshmen to the sacred precincts of School. Such an honour was deserving of fitting ceremony, and thereby hangs a tale. On the morning of September 29, the official sophomore welcoming committee was very much in evidence, painfully so, and from that date until October 15, there existed an air of hushed expectancy punctuated at frequent intervals by local flurries. Then the storm broke. Well organized, well carried out and well ———, the initiation ceremony was finally voted one of the best and liveliest since the "good old days." It carried with it an aura of good fellowship and good fun, and will provide the source of pleasant memories for a good many years to come. Then came the reaction. Each year, something happens to call forth the wrath of the powers that be, but the fellows take their medicine standing up as all Schoolmen should. Last year, it was Burwash, the year before, it was Sheas, and this year, Whitney Hall acted as the red rag to incite a few misguided bulls to invade its sacred sanctum in the name of fun.

Although the time-honoured Soph-Frosh banquet has been done away with, its place has been taken by an event which far outshines it in glory. Mere words cannot express our appreciation of the delightful dance given in our honour by the freshmen in the Banquet Hall of the Royal York. It certainly speaks well for their executive.

Sports now come to the fore to hold our attention, and again 3T4 proved its worth. On the rugby field we were well represented both in intercollegiate and interfaculty. The Orfuns claimed three stars from the year, while on the big team our sole representative was Peacock. Hockey, basketball and water polo were enriched by players from our year. The greater part of Junior School teams were men from 3T4, so altogether we have acquitted ourselves with valour even though not covered with glory in the field of sports.

The next great event to hold our attention was the Junior School At-Home, that premier social event of the pre-Christmas term. Those who attended achieved the heights of enjoyment and satisfaction, and those who were unable to be there have since sunk to the lowest depths of despair and remorse. Great credit is due to the committee who gave their time and efforts unsparingly to provide us with the acme of successful entertainment, as it certainly proved to be.

Then came Christmas holidays and exams., that bugbear to university life. But after the rush and worry was over, the stage was well set for the year party. The Lakeshore Boulevard was lined for miles with cars as their owners made merry to the music of the Varsity Entertainers in the pleasant environment of Hick's Grill. Bacchus was the toast of the evening and gaiety ruled supreme as 300 Schoolmen enjoyed themselves as only Schoolmen can.

Then came the elections and again 3T4 scored. In the coming year Hart House will be practically run by members of our year, and the Engineering Society will be enriched by the presence of three of our leading lights.

All in all it has been "one grand year" and 3T4 has been outstanding in the social, athletic and political world. May it continue to hold its rightful place in the sun. And now, with a great deal of regret, we hand over the reins of office to a new executive, and in retiring may we express our thanks for the wonderful support and co-operation we have received. You have elected an executive to be proud of, and let us urge you to give Mike Kellett, and his co-workers, H. L. Shepherd and H. J. Wilkinson, the same loyalty you have shown to us during the past year.

R. W. Anderson,
President

WILLIAM DONALD MITCHELL

On Tuesday, March 8, this faculty lost a promising student in the person of Don Mitchell. He had been in the Toronto General Hospital but a few days, suffering with pneumonia before his untimely death.

Don was born in St. Marys, Ontario, on December 15, 1910. He attended St. Mary's Collegiate Institute before coming to the University. In the fall of 1930 he enrolled in this faculty in the department of mining engineering. He spent the summer in the Tec Hughes Mines, and last fall transferred to the department of mechanical engineering. He was a member of the C.O.T.C. and was to have written his "A" certificate the day before he died.

Those who knew Don personally feel poorer in losing him. He was proficient in his work and showed signs of a promising career. His quiet and friendly nature made many friends at School and elsewhere.

J. DOUGLAS LOVELESS

On Friday, May 29th, 1931, 3T4 lost one of its most popular members. J. Douglas Loveless was fatally injured when he dove into a large cooling tank and struck a hidden dam at the plant of the Toronto Power Co. in Niagara Falls, where he was employed.

Doug was born in Agincourt in 1909, and received his training in the Agincourt Public School. He then entered Scarboro High School and won the McCowan Scholarship for highest standing in science and mathematics in his final year. Following an intense interest in electricity and a keen enthusiasm for its possibilities, he entered the University in the fall of 1930 as a student in Electrical Engineering.

Generous and unassuming, he was held in high esteem by all who were associated with him. His cheerful and unselfish nature won him many friends and he will always be remembered for his fine School spirit and manly bearing.

H. DOUGLAS TANSLEY

Schoolmen were deeply moved to hear of the death of one of their schoolmates, H. D. Tansley, who passed away on Sunday, February 14, in the General Hospital. Doug. had been taken to the hospital on Wednesday suffering from an acute case of appendicitis. A native of Carlisle, Ontario, he was a member of the class of 3T5 in electrical engineering, and was one of School's few reporters on "The Varsity" staff. His death came as a severe shock to his numerous friends in and around School.

3T5

To say our first year started with a bang is putting it mildly. As we were joyfully bounced down three flights of stairs by inspired Sophs, a mere bang went unnoticed. It was the soothing sound of running water which stirred many a frosh to noble endeavour, but to no avail. We were outnumbered 1.014 to 1.

Insult was added to injury when, having congregated for that solemn and awe-inspiring ritual, after which we were to be known as Schoolmen, we were gently relieved of 30c. a head to offset some of the expense. However, the executive of 3T4 must have seen "red" for a week, after counting most of it out in coppers.

The Soph-Frosh At-Home was held a little later in the Banquet Hall of the Royal York Hotel. No complaints have yet been received other than from inveterate drinkers of punch, who claimed that when the punch was being ordered somebody put his foot in it.

During this period, year fees were vainly being sought by the "Man Who Pays"—Bill Blake. 3T5 certainly exemplified that British motto—"what we have we hold."

In the second week of January, the Freshman Frolic was held at Hick's Grill, where Fred Culley upheld his end right nobly. Under the heading, "Things we would like to have seen," may we place first the sight of enthusiastic treasure hunters climbing up to the top of the business end of a steam shovel in a driving rain at midnight, looking for the next clue—perhaps they earned that chicken dinner.

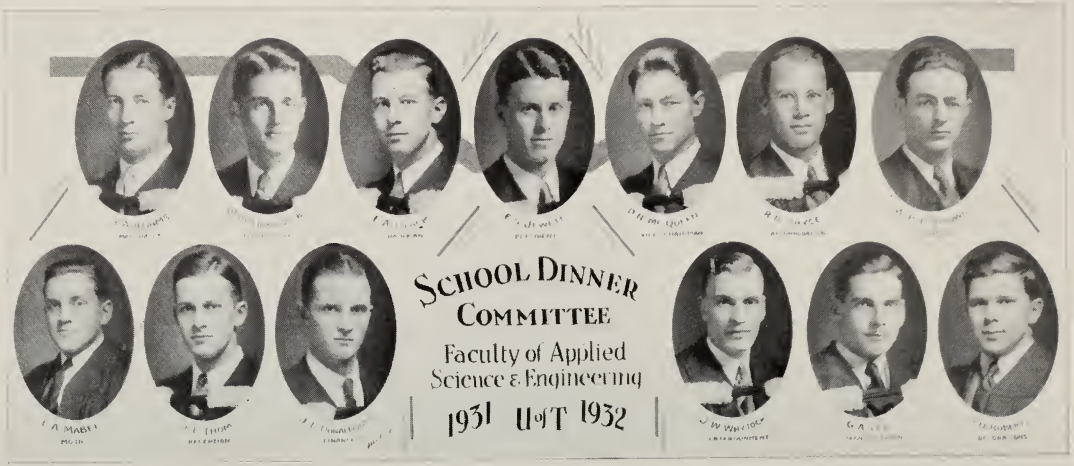
Such was our social life. Athletically, we soon became well-known. At the head of the list is Paul Hooper, the "dark horse" winner of the Durnan Cup for swimming as champion of the University. It is rumoured that Paul started life in a bathtub.

We were well represented in every line of sport, Carruth going to the finals in tennis singles and being elected president of the Varsity Tennis Club. G. Scott played for the Orfuns, and Hewitt, our vice-president, starred in Varsity junior hockey. Many others in 3T5 did notable work for both interfaculty and intercollegiate teams and will be heard of elsewhere.

And now the elections have passed us with a roar, leaving in the wake peanut shells, shaving cream, painted windows, and a new executive headed by Don Ritchie, for which office may we say that Robinson also "Ron".

We have learned many new things down at School, mainly at this period that in the spring a young man's fancy turns to—no, you're wrong—exams. 'Nuff said—more power to you.

D. B. Bruce,
President


SCHOOL DINNER
COMMITTEE
Faculty of Applied
Science & Engineering
1931 U of T 1932

School Dinner, 1931

The School dinner has long since ceased to be a mere dinner. For some time now, it has been an event for which all Schoolmen, and a few enlightened men of other faculties, have awaited eagerly and expectantly each year. And this year they were not disappointed when they gathered at Hart House on the evening of Tuesday, December 1st.

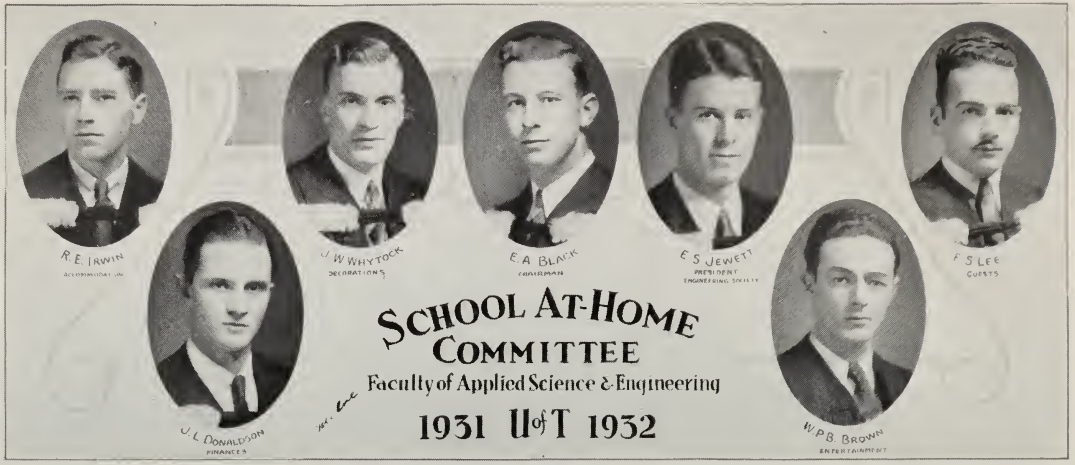
Although, presumably without culture, School at least showed a desire for it by securing as the principal speaker of the evening, Canon A. P. Shatford of St. James' Cathedral, Montreal. Canon Cody, who has been present at several previous dinners, introduced him in his admirable way. Canon Shatford's inspirational address held spellbound the 575 men present. In his "Challenge of the Crises," he called upon them to meet the present economic problems with the same confidence and determination that they employed in the practice of engineering. His pleas for unity, sacrifice and the spirit of adventure will long be remembered by everyone present.

School has always looked forward to seeing Sir Robert Falconer at the dinner. We were very disappointed last year, that owing to ill health, the President was unable to be with us. Consequently, this year's committee was greatly pleased when, on the evening of the dinner, Sir Robert was able to take his place at the head table. Dean Mitchell, in proposing the toast to "The University," put into words that which was uppermost in the minds of all those assembled—the regret that Sir Robert was soon to relinquish the office of President of the University, which he has so faithfully filled for twenty-five years. Sir Robert in replying, spoke of his deep sorrow at leaving. He stated, however, that he was confident that the university was destined to accomplish even greater things in the future, and that we were indeed fortunate to have as his successor such an able leader as Canon Cody.

Consistent with the fact that upwards of 600 Schoolmen were gathered together, the evening was not without merriment. Each year assembled in a separate room, and with the aid of a piano and the new song sheet, tried valiantly to raise the roof of Hart House. Later, Ross Workman took charge of the combined forces, and the Great Hall reverberated with the strains of "The Blue and White," "Engineers," "Clementine," and other favorites. The unexpected arrival of Santa Claus, accompanied by Ophelia, the "Wonder Horse," topped the evening. Santa, much to the enjoyment of those present, embarrassed several of the head table guests by reading extracts from letters he had received from them. All these features, together with the fine fare that Hart House provided for this event, helped to create the atmosphere of joviality and comradeship which was so apparent that evening.

And so, with a rousing "Toike Oike," another School dinner was written on the pages of history. We believe that it outshines all similar entries to date, but look forward to its eclipse next year by the Forty-third Annual School Dinner.

E. A. Black,
Chairman.


R. E. IRWIN
ACCOMMODATION
J. W. WHYTOCK
DECORATIONS
E. A. BLACK
CHAIRMAN
E. S. JEWETT
PRESIDENT
ENGINEERING SOCIETY
F. S. LEE
GUESTS
U. L. DONALDSON
FINANCE
W. P. B. BROWN
ENTERTAINMENT
SCHOOL AT-HOME
COMMITTEE
Faculty of Applied Science & Engineering
1931 U of T 1932

School At-Home

The coming of age of the School At-Home was executed in fine style. On the evening of February 26, over 300 of the university's most handsome and manly students, with an equal number of Toronto's most graceful and beautiful young ladies, gathered at the Royal York Hotel to "offer their congratulations." They were made welcome by Mrs. C. H. Mitchell, Mrs. C. R. Young, Mrs. R. W. Angus, Mrs. C. H. C. Wright, Mrs. W. J. T. Wright, Mrs. H. W. Price, Mrs. G. A. Guess, Mr. Jewett, the President of the Society and his lady.

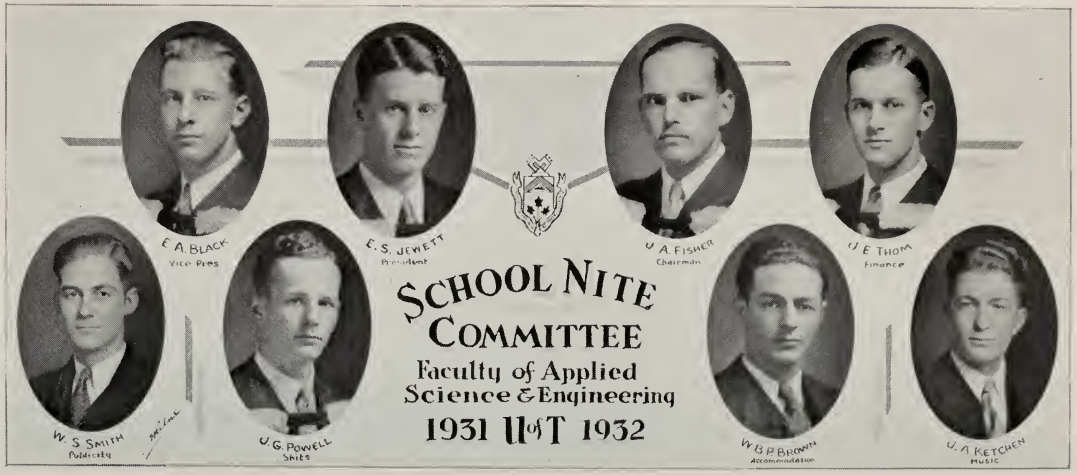
Dancing, held in the banquet hall, was a superb treat. The excellent music was supplied by the Wright Brothers orchestra. These boys alternated the slow, smooth, swaying melodies with brisk and peppy encores which brought repeated cries of "more." Besides many delightful colored lighting effects, the room was strikingly decorated with lighted balloons hung in clusters from the chandeliers. These clusters, looking much like huge bunches of grapes, aroused the interest and admiration of all those present. A novelty was achieved in the sixth dance when the orchestra played, in dance rhythm, several of the "School" favorites, including "Clementine" and "We Engineers." The numbers were accompanied by appropriate cartoons projected on the screen at one end of the hall.

At 12 o'clock we migrated to the concert hall to partake of food. The Royal York staff must have anticipated the capacity of Schoolmen, because, instead of the usual dainty "a-la-king," they served real lamb with good potatoes and peas. Blue and gold hats and noisemakers lent color and merriment to the party.

To the cry of "On with the dance," festivities were resumed in the banquet hall. Once more the Wright Brothers guided the steps of the gliding couples. The climax of the dance and the conclusion of the evening arrived simultaneously at 3 o'clock.

The glow of satisfaction and contentment on all faces was conclusive evidence that the School At-Home had achieved another triumph.

E. A. Black,
Chairman.


E A. Black
Vice Pres
E. S. Jewett
President
U A. Fisher
Chairman
U E Thom
Finance
W. S Smith
Publicity
U G. Powell
Shifts
W B P Brown
Accommodation
U. A Ketchen
Music
SCHOOL NITE
COMMITTEE
Faculty of Applied
Science & Engineering
1931 U of T 1932

School Nite

The perennial provocation for the perpetration of plenty of peculiarly profligate performances and the propagation of pulsing compositions by peppy people playing pianos with practised proficiency, interspersed with appropriate platitudes pointed particularly toward the patrons, revealed a painful propensity on the part of the players to perform their part in perfect prevention of premeditated substitution.

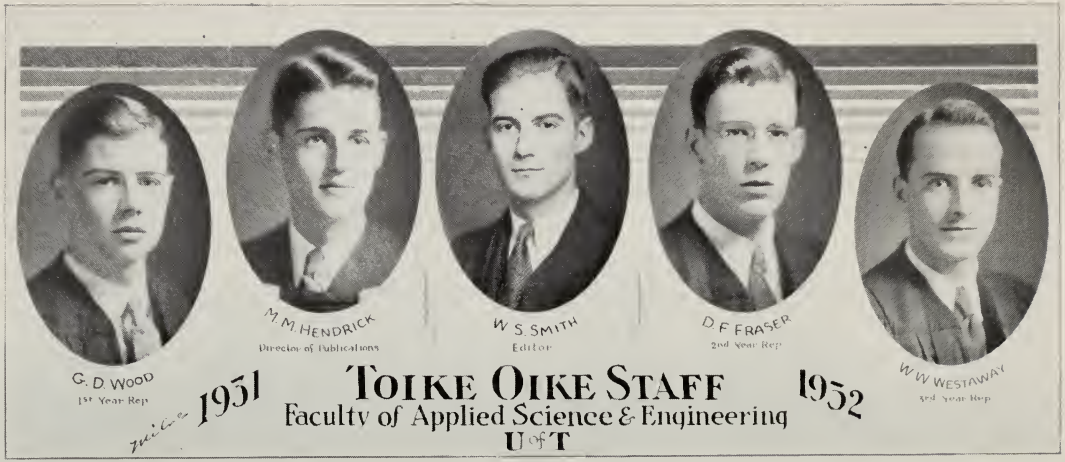
All of which is to say that School Nite was held this year on January 26 and seemed to have been a success. The skits were diverse in character and spicy in substance, and featured Bob Anderson in an iron-man act in the reading room; Withrow, McKillop & Co. in the first albino minstrel show in existence in the debates room; the Gull Lakers resplendent in practically nothing in the music room; and Johnny Goss, aided and abetted by Mrs. X and Mrs. Y in the plunge. The Varsity Entertainers syncopated satisfactorily after the hue and cry had died down, and congestion in the big gym was partially obviated by the use of amplification in the upper gym, this being the first time this feature has been used at a university function. The "Toike Oike" was augmented and changed in design from previous years with marked improvement, and we hope that this policy will be continued in subsequent School Nite issues.

J. A. Fisher,
Chairman.

Junior School At-Home

On Friday, December 11, 1931, the curtain rose on another triumph by Junior School. One hundred and fifty couples contributed their gaiety and good spirits to make this one of the greatest social events for many years past. Happy couples floated dreamily along to the syncopated melodies of the famous Ronnie Hart. Vari-colored spotlights shed an aura of mystery and romance over the whole ballroom, and combined with the bright hues of evening frocks, produced an altogether pleasing and soothing effect.

Promptly at 11.30 tables were set at either end of the great hall and a delightful buffet lunch drew the attention and admiration of all present. After the meal, a new sport was inaugurated, which threatens to take the place of the famous chariot races. During the lucky number dance obliging members of the Engineering Society executive offered themselves as spots and five couples were promptly placed on the spot. At the conclusion of the dance the five gentlemen mounted their fiery steeds and amidst encouraging shouts from the spectators, raced the length of the floor. The



1951 **TOIKE OIKE STAFF** 1952

Faculty of Applied Science & Engineering

U of T

winner won for his "ladye" a compact and for himself a solid leather billfold (just in case). Even the loser was not forgotten. His fair maiden received a replica of Doleful Desmond and himself a complete motor car which was evidently picked before it was ripe. Noisemakers made their appearance from the gallery, and amid the blare of toy horns, the softer notes of real horns and the grouchy remarks of "tin-horns," the party ended in a blaze of glory at 2 a.m.

Guests were received and welcomed by Mrs. C. H. Mitchell, Mrs. T. R. Loudon and Mrs. L. J. Rogers. The success of this major undertaking was due entirely to the ceaseless efforts of the committee—L. C. Benson, G. R. Black, G. B. Lint, D. B. Bruce, R. Hewitt, W. Black and J. A. Macfarlane.

R. W. Anderson,
Chairman

The Toike Oike

The pall cast over our modest publication last year has not lifted from us as yet. However, the Toike Oike has prospered. Though sometimes seeming a trifle boring to those lovers of mirth it has done its bit for School this year. Each issue has had a mission and has performed its duty nobly.

The Freshman edition was put into the hands of the first year men on arrival and served to enlighten them about several serious matters pertaining to university life. Then the Initiation edition put fear into their hearts, and warned them of impending danger at the hands of the sophomores. The School Dinner edition was a good means of publicity for this great event. Then with Yuletide came the Christmas edition, bedecked in green to wish one and all a very merry holiday and warn of the approaching exams in the new year. The School Nite edition fulfilled the four-fold purpose of publicity, programme, paper and directory. Then came the School At-Home edition, broadcasting far and wide the excellence, grandeur, and smart sophistication of that great formal function. The Election edition was a mass of ads which looked as if the set-up man had gone mad. The final issue was the Graduation edition, which wound up School affairs in general.

The editorial staff have functioned smoothly, and despite the adversities of censors, club chairmen and limited vocabulary, Toike Oike has finished a record year.

W. Stanley Smith,
Editor.


H W MASON
VICE PRESIDENT
T R LOUDON
R A ADAMS
PRESIDENT
H M SMITH
J R FITZPATRICK
SEC TREAS.
L J LIGHTY
3RD YEAR REP
C C N STRACHAN
2ND YEAR REP
E H SINCLAIR
ATHLETIC
ASSOCIATION
EXECUTIVE
Faculty of Applied
Science & Engineering
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The School Athletic Association

School teams this year have succeeded in winning five championships, which is an improvement over the showing made last year when only four championships came School's way.

The Senior School rugby team, after going through the round without being scored upon, finally met defeat at the hands of Trinity. The Schoolmen formed a strong team and are certainly deserving of credit for their good showing.

Once again the gymnastic team came to the fore and defeated the best the other faculties could provide.

In the tank we were again prominent. The Senior water polo team, after winning their group, were finally defeated by Victoria College, but in the swimming meet the mermen outswam their opponents to win the Fitzgerald Cup.

On the track, the honours gained by School in previous years were once more upheld. The outdoor season was completed with School winning quite handily while the indoor meet was not decided until the final day when three victories for School put them in the lead, which they refused to relinquish.

Junior School did very well in basketball and baseball. Having won their group, the basketball team journeyed to O.A.C., where defeat by one point eliminated them. In baseball, the Senior and Junior School teams are still in the play-offs, both having won their groups and it is quite possible that another championship may come to School.

To the Junior assault team much credit is due. After a plucky uphill fight, this team emerged victorious by a very small margin. Some promising new material was brought to light by the holding of this event.

Rowing this year was supplanted by lacrosse. School provided two teams but they were unable to get through their group.

In tennis it remained for S.P.S. to provide the two finalists These lads carried the honours of Varsity in the intercollegiate meet.

Hockey, soccer and other sports saw the teams of S.P.S. battling all the way, and the Athletic Association wishes to take this opportunity to thank the men who turned out and played for S.P.S.

Some twenty-five "S"'s were presented this year, and it would be most gratifying to see as many won in future years, as this certainly is an indication of the prominent part which S.P.S. has played in the athletics of University of Toronto.

R. A. Adams,
President

S.P.S. "T" HOLDERS

Back Row: C. E. Bannister, W. D. Smith, E. A. Peaker, H. L. Hayhoe, E. B. Hymmen, J. R. Fitzpatrick,

Front Row: D. W. W. Smillie, H. R. Collins, M. A. Elson, R. A. Adams, W. E. Algie, R. G. Westheuser.

Inset: F. A. Fell, H. M. Smith.

School in Intercollegiate Sport

Despite the loss through graduation of some twenty of School's prominent athletes, the freshman class brought to light some very promising material for future years.

Hickey, Westheuser, Hooper and Sinclair succeeded in making places on Varsity teams, the former two being with the track team, while Sinclair boxed with the Varsity B. W. & F. Club and Hooper was on the swimming team.

On the gridiron this year, Fitzpatrick at flying wing and Crocker at outside played sterling rugby for the Intercollegiates. Peacock, who looked like a certainty at middle wing, was injured in a practice, and was kept out of the game all season.

Britnell captained the Orfuns this year, and Smith, Elson, Scott, Bell and Hewitt all assisted in making this team a constant threat.

Hayhoe and Swallow were with the intercollegiate water polo team and both played great games, Hayhoe being the captain.

The swimming meet saw Withrow just beaten out for 1st after a mishap, while Hayhoe and Bell finished 2nd and 3rd respectively in the 440-yard free style. Hooper, who won the Durnan cup,, which is given for the individual swimming champion at Varsity was also on this team.

Gray, Bannister, Rudd and Sinclair were with the B. W. & F. team. Bannister lost a disputed decision and Gray won his bout.

Sirman, Craig and Vessie were with the gym team, while Bob Wilkinson was kept off due to an injury received early in the season.

Murray and Smillie were the only representatives on the hockey team. Murray captained the team, while Smillie was voted one of the most valuable men in the league.

Ed. Peaker pulled a strong oar for Varsity in the intercollegiate boat race, the day after he won the javelin throw in the track meet.

Connolly, Mal. Smith, Hickey, Westheuser, Hymmen, Peaker and Adams represented School in the intercollegiate track meet at McGill and all succeeded in winning points for Varsity.

SCHOOL "S" HOLDERS 1931-32

Front Row: M. A. Elson, H. A. Collins, W. R. Sirman, E. A. Peaker, R. A. Adams, W. E. Algie, R. E. Eaton, R. M. Wilkinson.
Second Row: S. Tenenbaum, C. E. Bannister, J. V. Reid, E. B. Hymmen, J. R. Fitzpatrick, R. G. Westheuser, W. D. Smith, J. A. Taylor, F. S. Lee.
Third Row: T. G. Howe, C. D. Martin, J. E. Anderson, G. A. Campbell, J. J. A. Howe, W. A. Campbell, J. G. Porter, H. L. Hayhoe, A. A. Jansen.
Back Row: W. D. McCallum, J. H. Byrne, E. F. E. Barrat, P. J. Howe, W. R. Coulter, G. G. Milne, J. A. Fisher.
Inset: H. M. Smith.

The Bronze "S"

"Hats off, gentlemen, to Ralph Adams!"

The Bronze "S" has again found a worthy possessor. Where could we find a better place to hang this old plaque than in the den of Mrs. Adams' home (or maybe in Ralph's own den sometime soon! Who knows?)

The "S" symbolizes achievement, and that is Ralph's middle name.

Ralph came to college to seek a Bachelor of Commerce degree but seeing the folly of his choice he rightly turned to Engineering.

His freshman year saw his first success in college track work at the end of which his efforts were crowned when he was chosen as a member of the Canadian Olympic Sprint Team.

In Amsterdam, while not achieving the highest pinnacle, he did remarkably well in his two races. On the Canadian tour after the games, he again did very well.

On returning from the "Games", he entered "School" but owing to the latness of starting here he did not compete in the Intercollegiate meet. During the winter he ran Indoor, both in Canada and the U.S.A. representing Canada on the International Sprint Team at the Millrose Games.

In the summer of 1929 he achieved the highest awards in sprinting for the Dominion, winning both Canadian sprint titles at Banff. That fall he was crowned Canadian Intercollegiate Sprint Champion.

In 1930 he was chosen to represent Canada in the sprints at the British Empire Games. He was a member of the victorious sprint team which set a new Canadian 440 yard relay record at this meet. Again that fall he triumphed in the Intercollegiate sprints.

As a matter of fact, his college course has just been one success after another. Last spring he was elected to guide the destiny of School through another year of sport being made President of the Athletic Association and who can say that he has not done it well?

Again last fall he won the Intercollegiate track honours, while during the winter he sliced off quite a few points for School in the Interfaculty Championships which was a decided factor in winning the championship for us.

But Ralph did not confine his activities to track and the presidency only. When there was a baseball game he was right there. He also took a crack at football but due to pressure brought to bear by officials, he remained with the track squad.

How about the Olympics this year, Ralph? We're sure we can say that all S.P.S. will be waiting to hear of your success.

SENIOR SCHOOL RUGBY TEAM

Standing: D. Grant (Manager), A. W. Moffat, F. V. C. Hewitt, W. J. Beynon, W. R. Coulter, M. J. Werry, L. J. Lichty, E. A. Mabee, H. M. Smith, K. G. Mitchell, J. V. Reid, J. A. MacMillan (Coach).

Kneeling: W. D. McCallum, T. A. Kirk, T. G. Howe, J. G. Porter, F. R. West, L. K. Walkom, H. F. Wheaton, F. J. Stubbs, F. R. Gurney, E. O. Hallett.

Senior Rugby

The usual custom of the Senior School rugby team is to do most of its practicing during the games, but most certainly it was not the case this year. The boys were out early and often, and each man had to fight even to be recognized among the sterling players who responded for practice. It was always a toss-up whether the best men were on the field or on the side-lines.

As everyone knows, the team suffered defeat because they had too little opposition. They won their group hands down, piling up 76 points and allowing not a single point to be scored against them. So it was a big surprise when they lost the semi-final to Trinity, that much under-estimated dark-horse which went right through to defeat Victoria in the finals. Perhaps if a defeat, or a good scare, had come along earlier in the season, the "Mulock Mug" would again be back, where it is much more at home.

No resumé of this team would be complete without mentioning the untiring efforts and wholehearted support of their coach, "Scotty" MacMillan, and the brilliant playing and steadying influence of the rest of the players of their popular captain, 'Beef" Lichty.

The old School spirit was always abounding in the team and the splendid and enthusiastic way that each man turned out for practice was most encouraging.

The players were mostly third year men and, although the services of all the present seniors will be greatly missed, there is still plenty of material to create a team which may easily recapture the cup. In other words, "Watch Senior School next year."

May I take this opportunity to thank "Scotty" MacMillan, the Athletic Association and all the members of the team for their wholehearted co-operation. It was a very great pleasure to manage such a group. May Senior School, next year, have all the luck and a more impregnable psychology.

DUNCAN G. GRANT,
Manager

Junior School Rugby

The prospects for a championship team this year looked none too bright owing to the graduation of the nucleus of last year's team to senior ranks. However, the opening two weeks found sufficient material ready and those in charge found it difficult to weed out a team. The team, not possessing a great amount of weight and offensive strength, depended solely on its fighting spirit and defensive play, which were characteristic of every game.

Junior School was successful in its first game with Junior Meds. by the score of 10-0. However, they were toppled in the next game, 9-2, by the well-coached U.C. team. School's next game with

SCHOOL SOCCER TEAM 1931-32

Back Row: L. B. Jones, W. C. G. Fraser, H. W. Mason, W. D. Johnston.
Front Row: J. A. C. Bowen, F. J. Billet (Captain), Prof. E. A. Allcut (Coach), W. E. H. Brawley (Manager), M. Ward (Asst. Coach), N. N. Smith, R. E. N. Davey.
Absent: O. F. Bush, H. L. Bayley, H. G. Kibble.

Meds. was a decided upset when the Engineers (still groggy from their excursion to Buffalo, etc.) lost by the score of 3-1. In the final game School scored revenge over the much-touted U.C. team when they came from behind to win by 6-4 in a well-played game.

The tackling of the team was outstanding, Hill, Kelly, Glover, Welch, Thomas being the aggressors. The attack of the team depended on the forward passing of Welch, kicking of Farquhar, the running of Collins, and the line play of Boyle, Thomas, Baker, Freeland and Strachan.

The team, while they did not win their group, more than redeemed themselves and by a splendid aggressive spirit and fight, it upheld the old School ne'er-say-die spirit.

Team—Waring (Capt.), Hayhurst, Nantell, Bryant, Hill, Finch, McLachlan, Baker, Freeland, Thomas, Boyle, Kelly, Powlesland, Menell, Glover, Farquhar, Lotimer, King, Welch, Collins, Strachan, McNichol (coach).

T. C. Muir,
Manager

S.P.S. Soccer

In beginning the season of 1931-32, S.P.S. soccer enthusiasts felt keenly the loss of such valuable players as Gregg, Ward, Franklin, Lawrence, Haggart and Graham.

Grant Gibson started the ball rolling this year by rounding up much new material and getting everything into shape. Pressure of studies and other duties forced him to resign as manager and Bill Brawley, who played last year, was named as his successor and carried on the work well.

As a result, S.P.S. fielded a strong team, which, although not entering the finals, gave U.C. a run for group honors. In a group consisting of U.C., Wycliffe, Dents and S.P.S., the team lost only one game and that by a score of 2-1 to U.C. The second game with U.C. went full time and resulted in a scoreless tie.

Professor Allcut, as always, lived up to his position as coach and gave the team many helpful suggestions. He was ably assisted by Matt Ward, who was out on the field with the team for every practice.

The season of 1932-33 should be a banner year for S.P.S., since if the toll of exams is not too great, every man who played this year will be out again next year. This, combined with the good work of Davey in goal, should take the team well on into the finals.

W. E. Brawley,
Manager

S.P.S. JUNIOR ASSAULT TEAM
INTERFACULTY CHAMPIONS 1931-32

Back Row: H. J. Hoseason, H. Mason, E. C. Rudd (Manager), G. Dimitrieff, C. S. Boland.
Front Row: O. F. Bush, J. J. Howe, J. B. Gray, E. R. Eaton, E. H. Sinclair.
Absent: C. C. Thomas, V. Zachanko.

School B. W. and F. Club

School got away to a good start this year by putting on the best faculty assault and then following this up by a win in the junior interfaculty meet.

To the freshmen go the laurels, for they not only won the inter-year tilt, but came back with three wins in the junior. These men will keep on bringing victories to School in the next three years.

Thomas chalked up School's first win in the junior interfaculty when he boxed his way through a nice bout in the flyweight class. Sinclair, another new comer, entered in both boxing and wrestling, but was beaten chiefly by the number of bouts in the welterweight division. In the boxing, however, he scored a technical knockout in the semi-final and took the final by a nice margin of points. This man, by the way, represented Varsity in the intercollegiate assault and put up a very creditable showing against the crack boxer of the McGill team.

In the other weights, School had good prospects in such men as Gauvreau, Bush, Wallbridge and Eaton, all of whom showed the old School spirit, requiring some very hard decisions from the judges.

The wrestlers also contributed their share, taking two final bouts. Zachanko, another freshman, added to his reputation gained in the School assault and, in a business-like manner, put away his two opponents for the 158-pound honors. In the 134-pound class, J. Howe put an end to the sensational advance of Oille, who had formerly been in the habit of taking straight falls. Howe has another year to go and will be heard of again. Dimitrief and Mason were also in the finals and gave good accounts of themselves.

In the senior assault, we were short many men, due to sickness and injuries, and the weakened team fell far behind the example set for them last year.

However, four of our men made the trip to Kingston with the blue team. Bannister was robbed of a well-earned victory, while Gray, in the heavyweight class, accounted for a Varsity point.

E. C. Rudd,
Manager

S.P.S. OUTDOOR TRACK TEAM
INTERFACULTY CHAMPIONS 1931-32

Back Row: E. A. Peaker, R. G. Westheuser.
Centre Row: M. McKillop (Manager), J. A. M. Austin, R. D. Walden. J. J. Hickey.
Front Row: R. A. Adams, H. M. Smith, E. R. Eaton, Prof. E. A. Allcut (Hon. Pres.), F. S. Lee. J. H. Byrne, E. B. Hymmen.
Inserts: D. S. Holmested, W. A. Connolly.

Outdoor Track

Once again the old cup stays with School. This year's track team demonstrated its ability by winning the interfaculty championship by a wide margin over U.C., their closest competitors.

School had the honour this year of having the only record-breaker as a member of its team. Walt Connolly, in smashing his own record for the 220-yard hurdles, left a time that will probably be broken only by himself in some future meet. He performed no less brilliantly in capturing the high hurdles as well. Ralph Adams, who for the past three years has captured all the sprinting laurels, both interfaculty and intercollegiate, again showed his Olympic form in taking these events. In the 440-yard dash, Mal Smith was again successful in winning. John Hickey, a freshman, showed great promise in the hurdles, being close to Connolly in both events. In the relay race, School were beaten by Trinity, who surprised everybody to take the laurels for the first time in their history.

School fieldmen were particularly strong, accounting for many points. Eddie Hymmen won the broad jump for the fourth year in succession, and Eddie Peaker showed his usual form in the discus, shot and javelin, while Westheuser, a freshman, is carrying on just where Ed is leaving off.

This year's graduation will eliminate many certain point-winners from the 1932 team. Adams, Peaker, Lee, Hymmen and Smith will be among the missing. However, with the material on hand and some support from the coming freshmen, our track team should continue its winning habits.

H. M. Smith,
Manager

Lacrosse

Many of us have felt for a long time that Canada's national game should be included as a recognized sport in interfaculty athletics. The great handicap has been the fact that, heretofore, lacrosse has been an outdoor game and the weather has always frustrated any thought of playing it on the campus. However, this year a box lacrosse league was formed to play the games in the big gym and it was a sterling success. Stan Seal of Victoria was the "big gun" behind the league and he was elected its first President. Many Schoolmen, former lacrosse stars in their own home towns, turned out for the first meeting. W. E. Algie was elected as the S.P.S. representative on the executive.

Two groups were formed—Senior School being entered in the first and Junior School in the second. Since it was impossible to get the big gym at five o'clock due to basketball, it was decided to

S.P.S. INDOOR TRACK TEAM
INTERFACULTY CHAMPIONS 1932

Back Row: J. R. Fitzpatrick, M. E. Hertel, J. A. M. Austin.
Centre Row: F. Krailo, J. H. Byrne, J. L. Donaldson, J. J. Hickey, F. S. Lee, T. G. Howe.
Front Row: R. A. Adams, E. R. Eaton, Prof. E. A. Allcut (Hon.. Pres), H. M. Smith (Manager), J. J. A. Howe, E. B. Hymmen.

play the games from four to five. This proved a great handicap to the School teams owing to the necessity of attending labs. At times it was impossible to field a full team, much less the best one. However, both teams made a very good showing and with some practice next year they should have no great difficulty in capturing the championship won by Victoria this year.

As far as School is concerned, if the games next year cannot be played after five o'clock, it would be a waste of time and money to enter. With this obstacle removed, we may look forward to a good season in lacrosse next year.

W. E. Algie,
Lacrosse rep.

Indoor Track

What a meet! Not until the final event was run-off were S.P.S. acclaimed the champions. The enthusiasm shown when School's mile relay team beat U.C. to clinch the meet may be likened to a Varsity rugby team beating Queen's. The final score was: S.P.S., 48; U.C., 43; Medicine, 25.

School, as usual, scored most of their track points in the sprints, failing to gain any at all in the longer events from the half-mile up. Ralph Adams led the team with two firsts won in the 100 and 200-yard dashes. Johnnie Fitzpatrick, his Hamilton pal, decided he needed a little exercise and donned his uniform to take second place in the 50-yard and tie for third with Mal Smith in the 100-yard events. Mal also came second in the 220 and 440-yard dashes.

In the relay races, S.P.S. again showed the way. The half-mile relay team, composed of Fitzpatrick, Hymmen, Howe, Hickey, Smith and Adams, came within two seconds of breaking the record already held by the S.P.S. team of 1930. The mile relay team, composed of Fitzpatrick, Hickey, Adams and Smith nosed out U.C. to make certain of winning the meet. In both the relay events, the S.P.S. "second" team took third place, winning in each case from U.C. "seconds".

In the field events, School had a big advantage over U.C., who did not score a single point. In the pole vault, Harry Byrne was tied for first, while Mac Hertel leaped high enough to win a third. In the standing broad jump, Austin gathered in a very welcome five points. Mal Smith tied for second but had to be satisfied with a third in the jump-off.

It is to be hoped that next year enthusiasm for track work will continue. Graduation will certainly make itself felt. To overcome this, everybody interested in track will need to boost and co-operate. Don't forget that summer training is the best possible means of improving your style, condition and ability. Remember, S.P.S. and Varsity need real track men.

H. Malcolm Smith,
Manager

SENIOR SCHOOL BASKETBALL TEAM

D. L. Tait, H. M. Smith, C. B. Britnell, Y. L. Wong, T. A. Kirk, L. J. Lichty.
Absent: H. M. Brouwers, S. Tenenbaum.

Senior School Basketball

Although not exactly covering themselves with glory this year, Senior School's Sifton Cup aspirants made a fair showing and gave new evidence of the fact that a School team may always be depended upon to put up a good scrap.

We were grouped with Senior Vic. and Dents, thus having a short schedule of only four games.

Due to delay in appointing a manager, there was no practice before the first game, which was won by Senior Vic., but only after quite a struggle. With four minues to play, the score was tied, but School was tiring rapidly and Vic. opened up and scored a 26-20 victory. In the second game, Dents floored a weak team and was handed a severe beating. The second round was practically a repetition of the first, School losing one close game and winning the other handily.

Thus Senior Vic. was declared group winner and our sweaters go back to the moth balls for another year.

The team:

Forwards—Kirk, Wong, Britnell.
Centre—Lichty, Brouwers.
Guard—Smith, Tait, Tennenbaum.

C. B. Britnell,
Manager

Junior School Basketball

Although losing out in the interfaculty basketball race, Junior School gave a good account of themselves before going down in the semi-finals.

Starting the season with five of last year's players to build around, and with the addition of Collins and Douglas of last year's Intercollegiate team, the Schoolmen gave every semblance of developing into a winning combination.

Owing to the withdrawal of St. Michael's from Interfaculty sport, School was left with O.C.E. in their group. Defeating the teachers in two straight games, 34-16 and 17-14, School captured their group title and the right to enter the play-downs.

The draw found School pitted against Guelph O.A.C. In the first game, the "Aggies" caught the Schoolmen below form and scored a 32-19 victory. In the return game in Guelph, the Schoolmen showed a reversal of form but were forced to go down to a 25-24 defeat after leading throughout most of the game. This loss meant elimination from the cup race.

Wilkinson, Waldon and Douglas formed a strong forward line with the former counting many a basket for his team. Collins, Cahoon and Hagerman played strong games on the defense besides

SCHOOL SENIOR WATER POLO TEAM

Back Row: J. C. Towers, H. L. Hayhoe (Manager), R. B. Bryce.
Front Row: J. A. Fisher, J. H. Addison, J. G. Powell, E. O. Withrow, H. M. Jones.

helping in the scoring. The rest of the team could always be depended upon to give their best when called upon.

The writer wishes to take this opportunity to thank the team for their splendid co-operation and wishes them the best of luck in their battle with "Mr. Exam."

The team: Hugh Wilkinson, centre; Ralph Waldon, Ted Douglas, Jimmie Hall, Elliott Carruth, forwards; Roy Cahoon, Hal Collins, Aubrey Hagerman, Roy Miller and Ken Clarke, defense.

S. Tenenbaum,
Manager

Senior Water Polo

This year interfaculty water polo was played after Christmas, instead of before as in other years. This enabled Senior School to turn out a full team, which is a very difficult thing to do in the fall, as rugby gets the call over water polo. Moreover, the team had all the earmarks as being due for the championship, as, with the exception of Eddie Peaker, who guarded the big cage, every man had played for School for the last three or four seasons.

The group schedule was short, there being only four games, of which Senior School won three and tied one to lead the group. In the semi-finals, Victoria, the cup winners, taught School the lesson that team play and condition, as well as experience, are necessary to win the championship, since they took the boys for two straight games.

Jack Fisher was the eagle eye of the team, getting School's only two goals against Vic. Jimmie Towers played a steady game at centre, and Bun Crocker kept things humming as rover. Bob Bryce, the old iron man and the big splasher of the team, with Mase Jones, played on the defense, Ev Withrow and Jack Addison providing the relief. Eddie Peaker, in goal, turned in some great performances as well, handling his job like a veteran.

Much credit and our appreciation is due Hank Hayhoe, the team manager and coach, whose untiring efforts carried the team to the semi-finals.

J. G. Powell,
Captain

JUNIOR SCHOOL WATER POLO TEAM

Standing: T. Bell, L. D. Dougan, J. S. Craig.
Sitting: W. A. Wood, D. F. Fraser, S. M. Archer (Manager), C. E. Hawke, F. R. Adams.

Junior School Water Polo

With five of last year's Junior team back and plenty of new material on hand, School's team was very good. The only opposition in the group was Junior Meds., who, unfortunately, proved an impassable barrier to the championship. Dents and Junior U.C. fell easily before School. Junior Meds came next and this game ended in a 4-all tie. Meds had the better of the play in the first half, then School got serious and finally took the upper hand, but only to tie the score. This game seemed to make the team pull together, for from then on, they practically monopolised the tank after lectures.

In the second game with Meds, the play was very even until Meds got away twice to win the game and the group, 3-1.

The team was made up of the following:—

W. Woods (captain), second year on the team and a good all-round player.

J. S. Craig, last year's captain, a strong swimmer and a good shot. He could always be counted upon to be where he was supposed to be.

T. Bell, intercollegiate 440-yard man, swam centre. It was seldom indeed that anybody beat "Tubby" to the tip-off.

C. S. Hawke, left wing, second year at the game and still improving. He accounted for a large number of School's goals.

D. F. Fraser, right defence, second year on team. Don was quite a worry to Meds—he always seemed to be in the way when somebody wanted to shoot.

F. Adams, left defence, second year on the team, swam well and helped Fraser keep the score sheet clear.

N. Boyle, the only freshman on the team, played well in goal and will be a great asset to Junior School next year.

A. L. Shepherd, L. D. Dougan, R. A. Webber were the subs and all worked hard. We hope to see them playing for Senior School next year.

As all except the goalie will be in third year next season, Senior School's chances for the championship look good, provided, of course, that they don't all make the intercollegiate team. Time will tell.

R. W. Archer,
Manager

SCHOOL SWIMMING TEAM
INTERFACULTY CHAMPIONS 1932

Standing: J. C. Towers, T. Bell, J. A. Fisher, C. E. Hawke, A. M. Vessie, J. G. Powell.
Sitting: E. F. Jull, J. H. Addison, F. B. Conron, H. L. Hayhoe, D. F. Nasmith, J. P. Hooper, E. O. Withrow.

S.P.S Swimming Team

INTERFACULTY CHAMPIONS, 1932

This year, School once more holds the Fitzgerald Trophy, donated by a Schoolman. We hold it on a win by a mere point, U.C. just failing to tie the score. The team was larger than usual and more enthusiastic.

Hayhoe pulled the surprise of the evening by winning the 440-yard free style. He also took second place in the 200-yard free style, with Bell coming in a strong third (Young style). Towers was beaten by mere inches in the backstroke to take second place. Withrow came close to record time in the 200-yard breast stroke in a fast heat. These places made up our total of 18 points, which was enough to win, especially when so many faculties were entered that the points were divided.

The rest of the team made noble attempts, especially in the relay when Powell, Fisher, Nasmith and Conron swam almost a dead heat with Meds. These four men along with Hawke swam the sprints, and Vessie helped Towers in the backstroke. In the diving, Gurney and Jull made a splendid showing.

The laurels for the best all-round swimmer at Varsity go this year to J. P. Hooper, winner of the Durnan trophy. Paul is a freshman and we congratulate him enthusiastically.

Most of the team graduate this year but we're looking forward to seeing the Fitzgerald cup stay at the Schoolhouse for many a year yet.

E. O. WITHROW,
Manager

SCHOOL GYMNASTIC TEAM
INTERFACULTY CHAMPIONS 1932
W. R. Sirman, R. M. Wilkinson, E. H. Sinclair.

School Gymnastic Team

School fielded a strong team in the interfaculty gymnastic meet this year, as usual, and were once more successful in retaining possession of the championship and the Harold A. Wilson trophy.

Sirman and Wilkinson, both members of last year's team, along with Sinclair, a promising athlete in more than one sport, carried the blue and gold to victory in the annual event.

With the ever-increasing interest shown in gymnastics by men of S.P.S., the Little Red School House should long continue to be the resting place of the interfaculty championship.

R. M. Wilkinson,
Manager

Tennis

This has been a very successful year in tennis, as far as School is concerned. The interfaculty tournament was held last fall at the Toronto Tennis Club, and although a very small percentage of the ninety-odd entries were Schoolmen, two of these fought it out in the finals, and the same two combined to make the No. 1 doubles team at the intercollegiate meet at Kingston. I had the good fortune to win the final match, my opponent being Elliott Carruth, 3T5 Mechanical. At Kingston, where the meet was held on the R.M.C. courts, we competed against teams from McGill, University of Montreal, Queen's and R.M.C. Elliott and I managed to gather a point in the singles before being browned off by members of the strong U. of M. team, who cleaned up on the whole meet for the first time in their history. Two of these fellows from the U. of M. are to be given a tryout for the Davis Cup team this year.

My big bellyache is the lack of interest taken by Schoolmen in tennis, as judged by the small number entered in the interfaculty tournament. This is the first time in many years that School has had a representative on the intercollegiate team. Next year—the next three years in fact—Elliott Carruth will be the backbone of the the intercollegiate team. How about more Schoolmen entering the tournament and trying to get somewhere in it! It's a wonder what a little concentrated practice will do before a tournament like that. Where possible, play every day during the summer, and what's also important, play in tournaments whenever you can—they're fun besides. Just take the game a bit more seriously than you have been used to. And remember, it isn't a game you give up as soon as you leave college. It'll provide you with active exercise until you're a dithering old fogey of 90. Marcel Rainville, Canada's No. 2 ranking player, didn't start playing serious tennis until he was 24 years old. How about it?

Bear in mind that really first-class tennis requires as much condition and stamina as any other sport you care to mention.

W. M. R. Griffin,
Vice-President, U. of T. Tennis Club.

SENIOR SCHOOL HOCKEY TEAM

Standing: C. D Martin, J. A. Fisher, E. A. Mabee, K. G. Mitchell, J. H. W. Bates, J. G. Porter, W. M. R. Griffin. M. J. Werry, J. S. Crerar.

Sitting: J. E. Anderson, L. K. Walkom, C. J. Bridgeland, W. D. McCallum, J. V. Reid.

Senior School Hockey

The undefinable weather of our so-called winter turned out to be the biggest boon interfaculty hockey has ever received. As a result, a new double schedule was drawn up of 30-minute games to be played on the artificial ice surface in the arena.

Despite the heartbreaking defeat which School was compelled to suffer at the hands of Dentistry this year, the team as a whole put up one of the greatest displays of fight and team spirit that has ever been exhibited by any School team.

Battling from the drop of the hat, School defeated in succession U.C., Meds and again U.C. The next game was, however, the team's nemesis; as Dents, by virtue of a fluke goal, shot from centre ice, received a 2-1 decision. School came back to gain a 4-0 win over Meds, and thus required a win over Dentistry to tie the group, as the Dentists had not lost a game.

On Monday, March 7, the teams locked horns, and for a real honest-to-gosh battle this game certainly excelled. With play ranging up and down at a terrific pace during the first period, and neither side able to score, School elected to "gang" the play, and the second half was a nightmare for Dentistry. Only twice in the fifteen minutes did the puck come inside the School blue line, and how they ever missed scoring on five different occasions is one of the world's seven "modern" wonders. Apparently it was not to be, for School failed to get the break for which they fought so gallantly, and the game ended a scoreless deadlock. Dents, by reason of this tie, nosed School out of first place by one lonely point.

The strength of the team as a whole is well illustrated by the fact that they scored thirteen goals in six games to their opponents three. To pick out stars on such a team is to do the team as a whole an injustice, since it was on team play and fighting spirit that they showed excellence. The goal-tending of "Monty" Werry is, however, worthy of the highest praise, and in front of him "Chuck" Bridgland showed a style and speed comparable to that of a Bruce Paul; "Red" Crerar, "Jimmy" Anderson and "Big Bill" Griffin, on the forward line displayed neat and tricky combination plays that were sensational in timing and effect. With them, the dogged determination and persistence of that incomparable pair of "muckers"—"Mike" Mitchell and "Jo-Jo" Reid, rounded out the spirit and fight of a well-balanced team. Lastly, the all-round ability of Martin, McCallum, Porter, Walkom and Maybee proved the mainstay of a strong secondary staff.

In conclusion, may we say, that while we, as a team, extend the heartiest congratulations to Dentistry on their victory, we feel that it was more the breaks of the game, than lack of ability, which deprived School of a place in the play-offs for the Jennings cup this year.

J. H. W. Bates,
Manager

JUNIOR SCHOOL BASEBALL TEAM

Back Row: K. Kennedy, R. L. Miller, D. N. Cook, H. T. Turley, J. C. Anderson, B. H. Carveth, J. J. Dutton, W. S. Smith (Manager).

Front Row: J. C. Knapp, V. D. MacLachlan, J. P. Borbey, H. W. Mason (Captain), E. R. Eaton, T. J. Wells, H. H. Johnston.

Junior School Baseball Team

Junior School was the black horse in this year's interfaculty baseball series. The team was composed entirely of men who had never played indoor baseball in Hart House gym before and those who have done so know how difficult it is to really get onto the job of catching fast ones off the walls and rafters.

The team got off to a bad start by losing their first game to Junior Meds. However, they won their group easily after that, although Junior U.C. and Junior Meds. fielded a smart aggregation of baseball players.

In the semi-finals, Senior Victoria were drawn. This much-touted group of nine were forced to play two hard games before they emerged victorious. Only the beneficence of Lady Luck pulled the final game out of the fire for Senior Vic.

The great pitching of Mason, heavy hitting and strong fielding, were the mainstays of the team.

Mason and Johnston formed a strong battery, although Vrooman and Miller kept up their end when necessary. The bases were well filled by Wells, Cook, Kennedy and Turley. MacLachlan, Carveth and Knapp covered shortstop quite efficiently, while Eaton, Borbey and Dutton grabbed off the long ones to the field.

The team will indeed be a nucleus for a championship Senior School baseball team next year.

W. S. Smith,
Manager

Junior School Hockey

For the first few weeks of the hockey season the outlook was none too bright due to the inclement weather. However, through the generosity of the Athletic Directorate, a schedule of games was drawn up to be played off in the Varsity arena. With the prospects of indoor ice, the turnout for Junior School was greatly increased and in the first game with Junior U.C., School presented a strong squad led by H. McNichol. School was successful in this abbreviated game by the score of 1-0 after a mediocre display. However, after further practices the team appeared much better against Junior Meds., whom they trounced by the score of 3-1, with Kennedy and McNichol as the goal-getters. In the next game against U.C., School showed nice team play to blank the Arts men 5-0, the work of Davidson, McNichol and MacLachlan being outstanding. For the final game against Meds., our defence was strengthened by the addition of Al. Williamson with the outcome that School finished their group with a clean sheet by a 2-1 win.

In the semi-final, School found themselves drawn against Victoria, who were strong favorites for the Jennings cup. In a game, featured by heavy body-checking and close defensive playing by the Victoria team, School, though carrying the play of their opponents,

SENIOR SCHOOL BASEBALL TEAM

Back Row: W. B. Proudfoot, A. W. M. Carmichael, E. S. Jewett (Manager), R. A. Adams, W. S. Campbell.

Front Row: T. J. Carbone, J. J. A. Howe, P. J. Howe, A. A. Jansen, G. W. Wilson, F. V. C. Hewitt.

found themselves on the short end of a 4-0 score. With this defeat Junior School was eliminated with much regret, as they had undoubtedly a great team and with a little better luck they might have brought back the Jennings cup.

Throughout the season McNichol was a tower of strength, both defensively and offensively. On the forward line he was ably supported by Davidson, MacLachlan and Fiebig, who formed a fast line. On the defence, the work of Kennedy and Williamson with their solo efforts resulted in more than one goal.

On the whole Junior School enjoyed a successful season and if this year's team can be taken as a criterion of the coming School hockey teams, we can look forward to having the Jennings cup back with us again next year.

Team—McNichol (captain), Ellsworth, Davidson, Finch, MacLachlan, Cunningham, Fiebig, Kennedy, Elliott, Burgoyne, Press, Williamson.

T. C. Muir,
Manager

Senior School Baseball

School again won their group title, thereby maintaining a long-established custom. This team contained six players who played on the interfaculty champions of 1928-1929.

The team made an auspicious start by easily defeating Dentistry in the first group game. The second game, however, was not a success from School's viewpoint, having to bow to Pharmacy by a wide margin. A new lease on life was taken and the old School spirit, combined with George Wilson's pitching, won the remaining two games, and with them the group title. The team showed heavy hitting strength, which is not an unusual condition in School baseball teams. This hitting, supported by sensational style in fielding, accounts fully for School's success.

The team lined up as follows:—

George Wilson pitched and Ralph Adams caught, the pair making a fine battery.

Austin Howe, 1st base; Bill Carmichael, s.s.; George Campbell, 2nd base; Tom Carbone, s.s., and Joe Howe, 3rd base, made up the infield.

The outfield consisted of Frank Hewitt, Ab Jansen, and Bev Proudfoot. At this writing the baseball series is incomplete, but strong hopes are entertained by School of regaining the Spalding cup after an absence of two years.

E. S. Jewett,
Manager


Lieut. M. M. HENDRICK
Major H. H. MADILL
SECOND IN COMMAND
V.D. U of T. C.O.T.C.
Lieut. Col. J. ROY COCKBURN
M.C. V.D. O.C. U of T
C.O.T.C.
Major W. J. T. WRIGHT
M.A.E. O.C. 'C' Coy.
Lieut. G. W. JACOBI
2nd Lieut. H. W. BEALL
2nd Lieut. F. R. CHARLES
2nd Lieut. J. W. LUTTON
H.Q. of the U of T. Contingent
C.O.T.C.
and the
OFFICERS of "C" COY.
1931-1932

C.O.T.C.

The old order changeth! No longer do Schoolmen belong to the gravel-crushers, but they have blossomed forth as artillery, signals and engineers. Messages sent or received, shells delivered and bridges built or blown up, while you wait.

After Remembrance Day, the company was reorganized into platoons of these branches. Our genial supervisor of publications initiated fourteen embryo Napoleons into the mysteries of the eighteen-pounder. We may state that it is "verbotten" to use this gun in fights with Meds or Vic or to intimidate voters at the School elections.

The signallers, chiefly Sophs who long ago learned the d(dances)/d(cash) of eighteen dollars, were soon deep in the manipulation of flags and the heliograph. Almost immediately new ideas and processes were formulated whereby one might receive a message accurately without knowing the code.

The engineers, principally Frosh, after learning to tie knots, devoted their energy to the construction of bridges over streams (that weren't there). Also they learned the fine art of blowing up and demolishing anything which, in their opinion, should not be in the landscape. Beware ye skulle and ye cross-bones.

It was not all work. Memories of the C.O.T.C. annual ball in the big gym at Hart House will be as nectar to those who attended.

Early in November we were disappointed to learn that Col. T. R. Loudon was giving up command of the battalion. However, this gloom was quickly dispelled when it became known that Major J. R. Cockburn was to succeed him.

"C" Company will regret the retirement of our genial friend and instructor, Sgt.-Major Noble, R.C.R., whose last parade took place on March 18. The Company extends its kindest regards to Mr. Noble and wishes him a happy rest after his busy military career.

J. W. Lutton,
Captain, "C" Company

The University of Toronto Rifle Association

It is indeed a pleasure to report on the activities of the U. of T. Rifle Association, and School's part in them, in this, the most successful year of its history. The reason for the last-mentioned condition is obvious. Our membership drive last fall resulted in a greatly increased membership, fifty per cent. of which came from the ranks of the "forty-beer men."

If the gentle reader will bear with us, we will, as briefly as possible, give him the low-down on the year's activities. The season opened at the Long Branch ranges as soon as the boys had located their new flop and hash houses. After three weeks' practice and profanity, the annual outdoor meet took place. According to custom, this was the occasion of the inter-university match, shot in

competition with the principal universities of Canada under D.C.R.A. auspices. In this match, everyone shoots at 200, 500 and 600 yards, wasting seven shots and two sighters at each range. The eight high men constitute the Varsity team and receive silver medals for their pains. The same competition decides the inter-faculty championship for the Delury Shield, the five high men from each faculty forming the various teams. For the benefit of the more practical-minded members, a large cash prize list always features this meet. On the occasion in question, School had one of those days, so we will pass lightly over this phase of the year's activities.

Indoor shooting commenced in the Hart House ranges in November and continued on into March. Spoon shoots were held in December, January and February. For greater equality of competition, members were divided into four appropriate classes according to proficiency, and a sterling silver spoon (price, $2.75) was presented to the winner of each group each month. The indoor championship was decided in three matches along much the same lines as was the outdoor title. Incidentally, General Mitchell's bullet-shaped decanter is now resting in peace in the Engineering Society. The boys didn't make any mistake when it was being discussed.

Further inducement to competition was provided this year, and will continue so to be, by Prof. Henderson in the form of pins for the eight high men in the indoor competitions.

The Annual Banquet, graced by the big shots of M.D. 2 and the U. of T., was held in Hart House by way of a winding-up ceremony. The boys displayed a skill in consuming cigarettes that was strongly reminiscent of the various club smokers.

To sum up School's part in the above activities, the following are the facts:—1st, as previously mentioned, the Mitchell cup. 2nd, of the twelve spoons presented, ten came to Schoolmen. 3rd, of the eight Henderson pins, six were being sported around "The Little Red School House" next day. 'Nuff sed.

As for next year, there are a flock of this year's frosh and sophs who know plenty when it comes to handling the shooting irons, and it is unlikely that they will forget how over the holidays. All we need is a continued supply from the incoming first year men. Come on, boys—never mind the green ties, we all wore one once.

We have a brand new treasurer in the person of George Clark, 3T4, and you can bet your pants we will have action next year.

That is all for this edition. But don't forget to turn out bright and early next fall. Rifles and ammunition are plentiful and free. If you can shoot, that is so much to the good. If you can't, it is time you learned. In either case, you will find that you will have lots of damn good company.

A. C. Macnab,
Treasurer.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

OPERATING STATEMENT

APRIL 1, 1931 TO MARCH 31, 1932

SUPPLY DEPARTMENT

Sales		$12,912.81
Deduct—Cost of goods sold:		
Inventory, April 1, 1931	$ 2,600.00	
Purchases	10,839.39	
	$13,439.39	
Less Inventory March 31, 1932	3,478.50	
		9,960.89
Gross Trading Profit		$ 2,951.92

GENERAL OPERATING STATEMENT

Gross Trading Margin—Supply Department		$ 2,951.92
Deduct—Salaries		1,355.50
Operating Profit after salaries		$ 1,596.42
Add—Fees	$ 1,614.00	
Interest and Discount earned	392.56	
School Night—Surplus	3.73	2,010.29
Available for Expenses and Deficits		$ 3,606.71
Deduct:		
General Expenses	$ 488.62	
Grants to Affiliated Clubs	100.17	
Donations, etc	260.85	
Dinner—Deficit	384.36	
Election Expense	231.01	
School At-Home	182.40	
Photographs	433.50	
Publications	1,033.18	
Loan Fund Expense	10.75	
Depreciation—Office Equipment	85.00	
Insurance	22.60	3,232.44
Excess of Revenue over Expenditure—to Surplus		$ 374.27

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

BALANCE SHEET

MARCH 31, 1932

ASSETS

CURRENT			
Cash		$ 38.70	
Bank—Savings		2,460.66	
Accounts Receivable	$655.75		
Employment	50.00		
Suspense—Returned Cheques	57.00		
	$762.75		
Less Reserve for Bad Debts	276.12	486.63	
Chemical Club	$ 9.63		
Industrial Club	20.00	29.63	
Interest on Bonds Accrued due	$ 50.00		
Premium on N.Y. funds	4.50		
		54.50	
Inventory—Supply Department		3,478.50	
			$ 6,548.62
INVESTMENTS			
Bonds—C.N.R. Ry. guaranteed by Dominion of Canada			2,000.00
DEFERRED CHARGES			
Unexpired Insurance			35.20
FIXED			
Office Equipment	$859.24		
Less Reserve for Depreciation	630.00		
		$ 229.24	
Smoking Room Furniture	$ 70.00		
Less Reserve for Depreciation	60.00	10.00	239.24
			$ 8,823.06

LIABILITIES AND SURPLUS

CURRENT LIABILITIES		
Accounts Payable	$ 1,272.00	
Bank—Current Overdraft	311.94	
		$ 1,583.94
Surplus as per statement		7,239.12
		$ 8,823.06